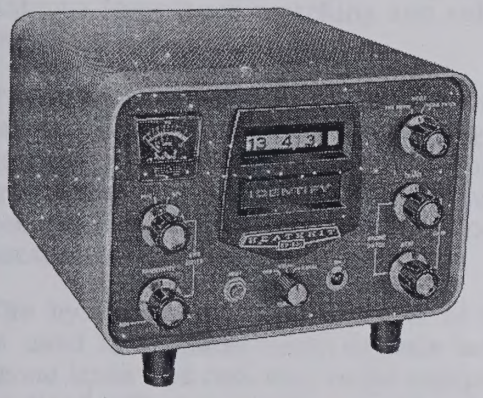
~~SER # 930-3340~~
CONDENSED

Assembly
and
Operation
of the

HEATHKIT®

STATION CONSOLE

Model SB-630



HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

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Assembly
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INTRODUCTION

The Heathkit Model SB-630 Station Console is a multipurpose instrument that includes an SWR (standing wave ratio) meter, a hybrid phone patch, a ten-minute timer, and an accurate digital readout clock. The Console was designed for use with an amateur radio station, or with other types of transmitters or transceivers.

The SWR meter section of the Console indicates the power transfer efficiency between a transmitter and antenna. If it is used with a transceiver, it will not affect receiver operation. The combination of very low insertion loss and high power rating permits the SWR meter to remain permanently inserted in a 50-52 Ω or 70-75 Ω transmission line. This permits constant monitoring of reflected power or SWR to determine proper transmitter tuning, transmission line-to-antenna impedance matching and relative power output.

The SWR meter section can also be used for other applications, such as testing the design of antenna coupling networks, checking other transmission systems, etc. The input and output connectors are standard SO-239 coaxial connectors.

The hybrid phone patch section of the Console is used to transfer audio signals between telephone lines and two-way radio equipment. It can be used either manually or with voice-control-operated (VOX) transmitters, without changing any connections.

When the phone patch section of the Console is used, the meter will indicate the VU level so you can monitor the phone patch output. This assures you that you are supplying the proper volume level to the telephone line so cross-talk is prevented. The meter also permits you to make a convenient null adjustment check (maximum null depth produces maximum isolation between the telephone line and station equipment, resulting in the best operating conditions for voice-control circuits). Proper match to the telephone line, with minimum hum, is provided by a specially designed hybrid transformer.

The ten-minute timer in the Console reminds you to give your call letters and identify your station at ten minute intervals, to comply with FCC (Federal Communications Commission) regulations. Either a visual reminder, or both visual and aural reminders, can be selected by a switch on the Console front panel. The timer can be reset at any time to start a new ten minute interval.

The electric clock has a digital readout dial which shows the hour, minute, and second. The clock is independent of all other circuits in the Console, and runs whenever the power cord is connected to the AC line.

The SWR meter and the hybrid phone patch require no AC power for operation. They can be used with the timer switch turned off or with the line cord disconnected. AC power is required for operation of the ten-minute timer and for the electric clock.

The styling of the Model SB-630 Station Console matches that of other Heathkit SB-series equipment, and its versatility makes it a useful instrument for any amateur or other radio station.

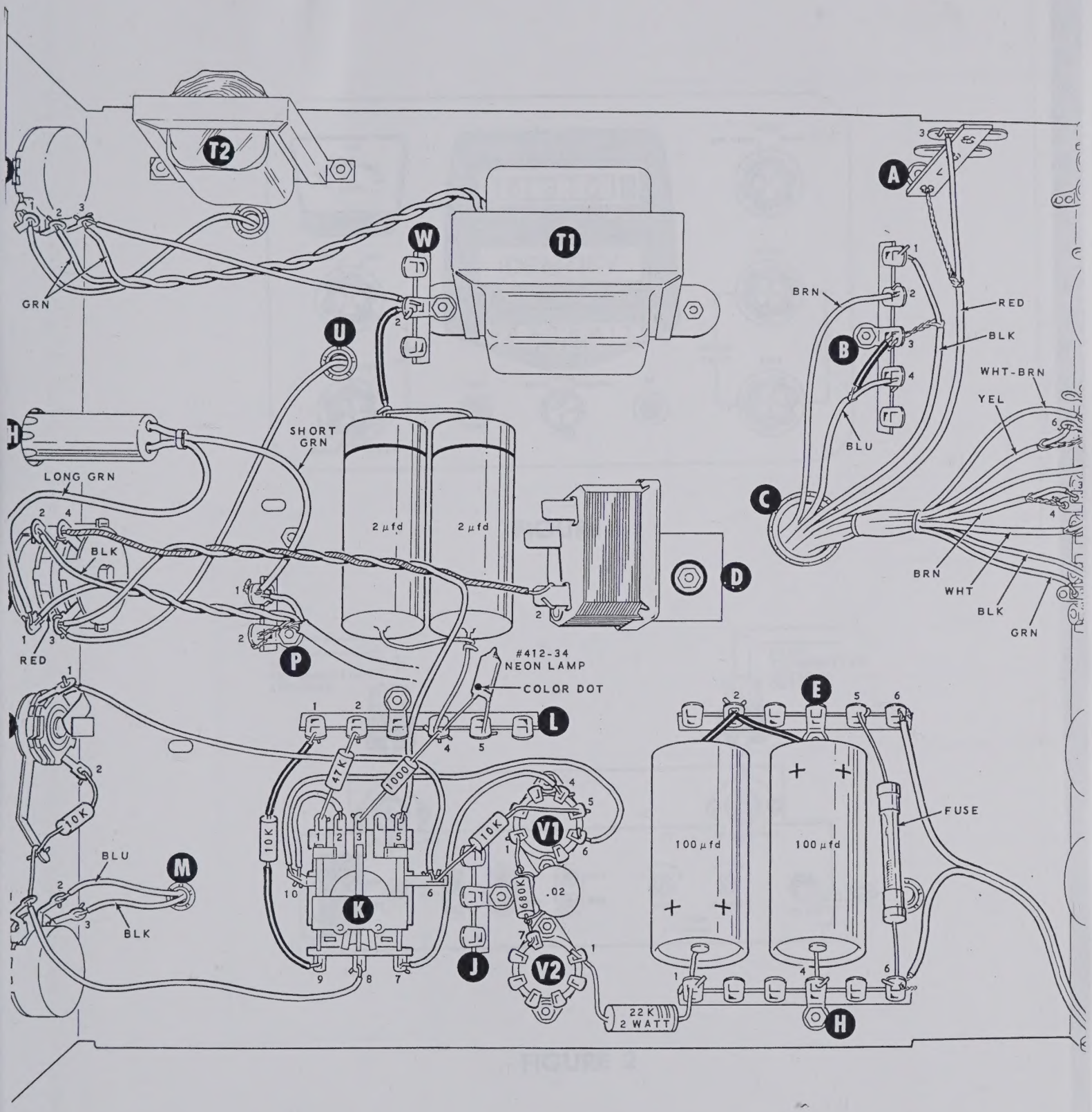
Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

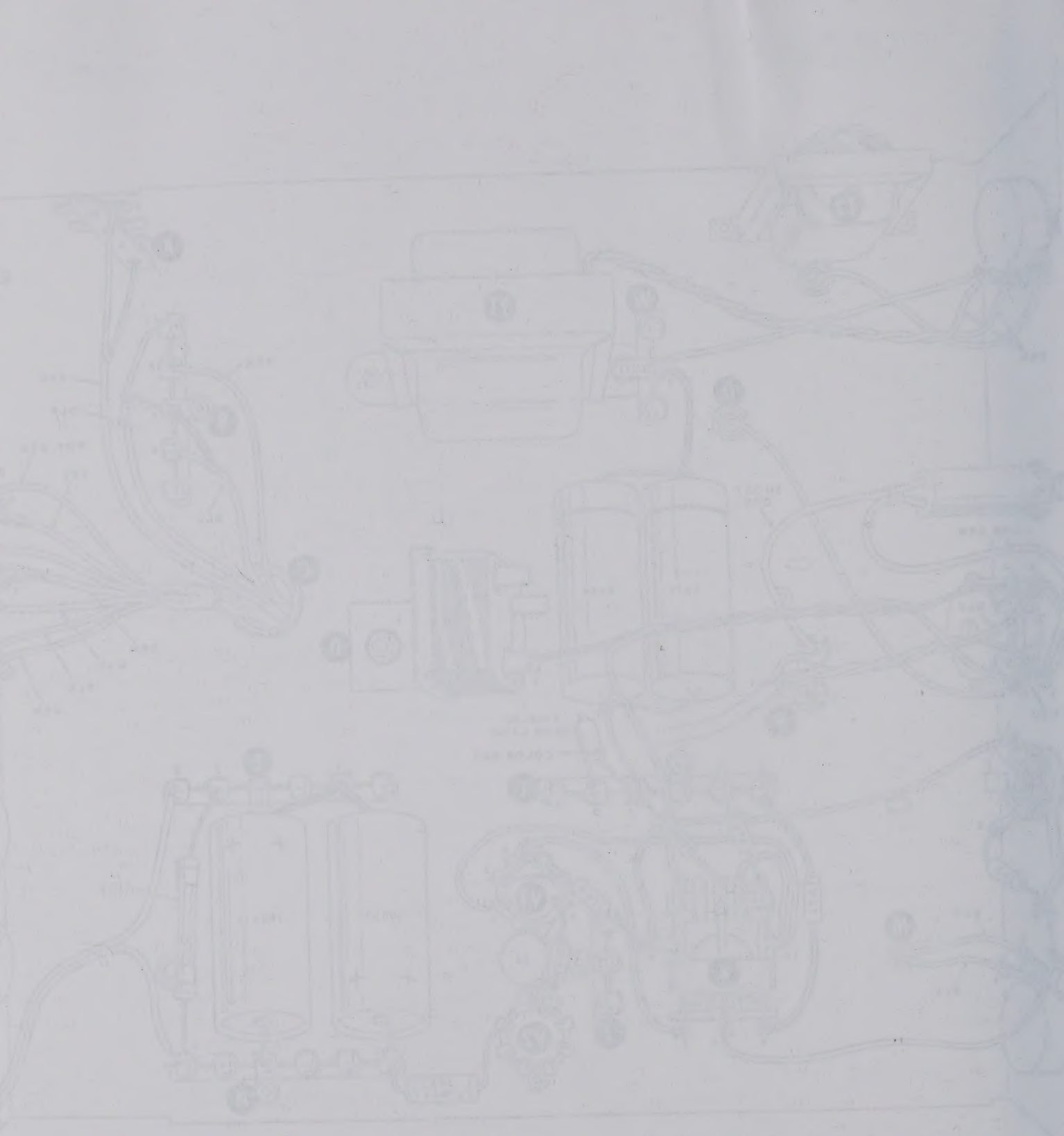
The numbers in parentheses in the Parts List are keyed to the numbers on the Parts Pictorial (fold-out from this Page).

PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS		
1/2 Watt		
(1) 1-103	1	33 Ω (orange-orange-black)
1-83	1	56 Ω (green-blue-black)
1-146	1	75 Ω (violet-green-black)
1-118	4	82 Ω (gray-red-black)
1-123	1	100 Ω (brown-black-brown)
1-7	1	680 Ω (blue-gray-brown)
1-9	3	1000 Ω (brown-black-red)
1-44	1	2200 Ω (red-red-red)
1-82	1	3600 Ω (orange-blue-red)
1-20	3	10 KΩ (brown-black-orange)
1-21	1	15 KΩ (brown-green-orange)
1-25	1	47 KΩ (yellow-violet-orange)
1-126	1	180 KΩ (brown-gray-yellow)
1-29	2	220 KΩ (red-red-yellow)
1-34	1	680 KΩ (blue-gray-yellow)
1-70	2	22 megohm (red-red-blue)
1-139	1	100 megohm (brown-black-violet)
2 Watt		
(2) 1-11-2	1	22 KΩ (red-red-orange)
CAPACITORS		
(3) 21-36	4	.002 μfd disc
21-27	2	.005 μfd disc
(4) 21-31	1	.02 μfd disc
(5) 27-34	2	.2 μfd resin
(6) 27-21	3	2 μfd tubular
(7) 25-57	2	100 μfd electrolytic
CONTROLS		
(8) 11-64	1	10 Ω wire-wound
10-11	1	50 KΩ
(9) 10-52	1	2000 Ω tab-mount
10-57	1	10 KΩ tab-mount
10-58	1	100 KΩ tab-mount
(10) 12-68	1	1500 Ω and 200 KΩ dual

PART No.	PARTS Per Kit	DESCRIPTION
SWITCHES		
(11) 60-2	1	DPDT slide
(12) 64-7	1	SPST pushbutton
(13) 63-177	1	2-position rotary
(14) 63-189	1	3-position rotary
(15) 63-428	1	2-section rotary
COILS-CHOKE-TRANSFORMERS		
(16) 40-98	1	RF driver element
(17) 40-99	2	RF pickup element
(18) 45-2	2	47 μH RF choke
51-129	1	Input transformer
51-130	1	Hybrid line transformer
54-92	1	Power transformer
DIODES-TUBES-LAMPS-FUSE		
(19) 56-26	4	1N191 germanium diode (brown-white-brown)
(20) 57-27	2	Silicon diode
411-59	1	OA2 tube
411-170	1	6EW6 tube
(21) 412-10	1	Snap-in neon lamp
(22) 412-34	1	Neon lamp
412-20	2	#47 pilot lamp
421-40	1	3/16 ampere slow-blow fuse
TERMINAL STRIPS		
(23) 431-16	1	2-lug
(24) 431-28	2	2-lug vertical
(25) 431-70	1	2-lug screw-type
(26) 431-62	2	3-lug miniature
(27) 431-10	2	3-lug
(28) 431-11	1	5-lug
(29) 431-45	3	6-lug
SOCKETS-CONNECTORS-PLUGS		
(30) 434-34	2	Tube socket
(31) 434-82	2	Double phono socket
(32) 434-88	2	Pilot lamp socket
(33) 436-5	2	Coaxial connector
(34) 438-4	3	Phono plug


T2
T1
W
U
A
B
C
D
E
H
J
K
L
M
P
V1
V2
GRN
BRN
RED
BLK
WHT-BRN
YEL
BLU
SHORT GRN
LONG GRN
2 µfd
2 µfd
#412-34 NEON LAMP
COLOR DOT
47K
1000
10K
10K
10K
.02
680K
100 µfd
100 µfd
FUSE
22K 2 WATT
WHT

PICTORIAL 9



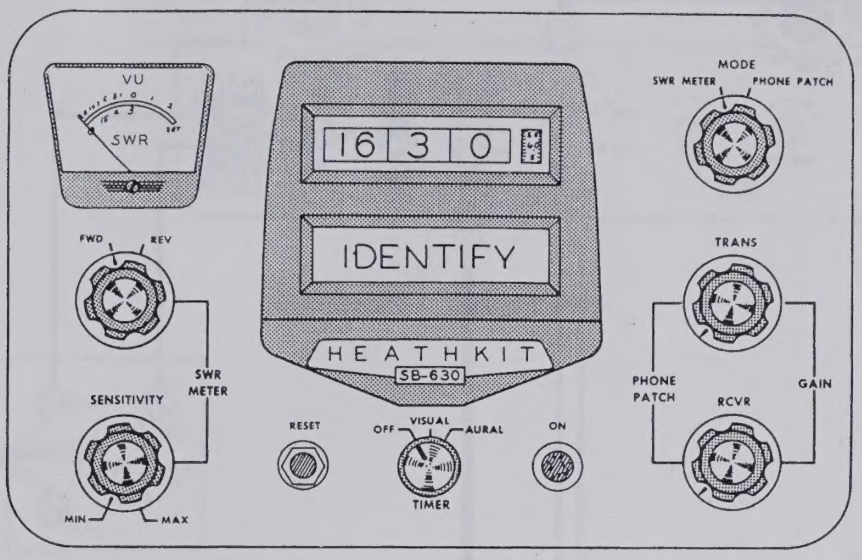


FIGURE 1

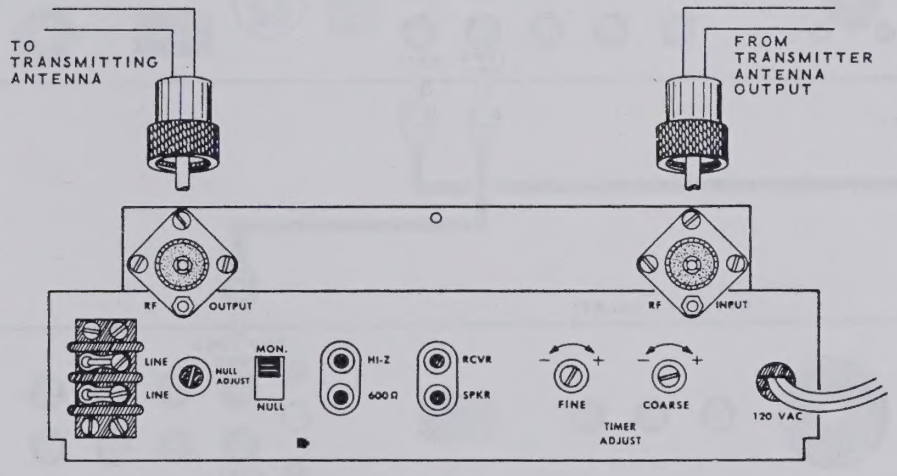


FIGURE 2

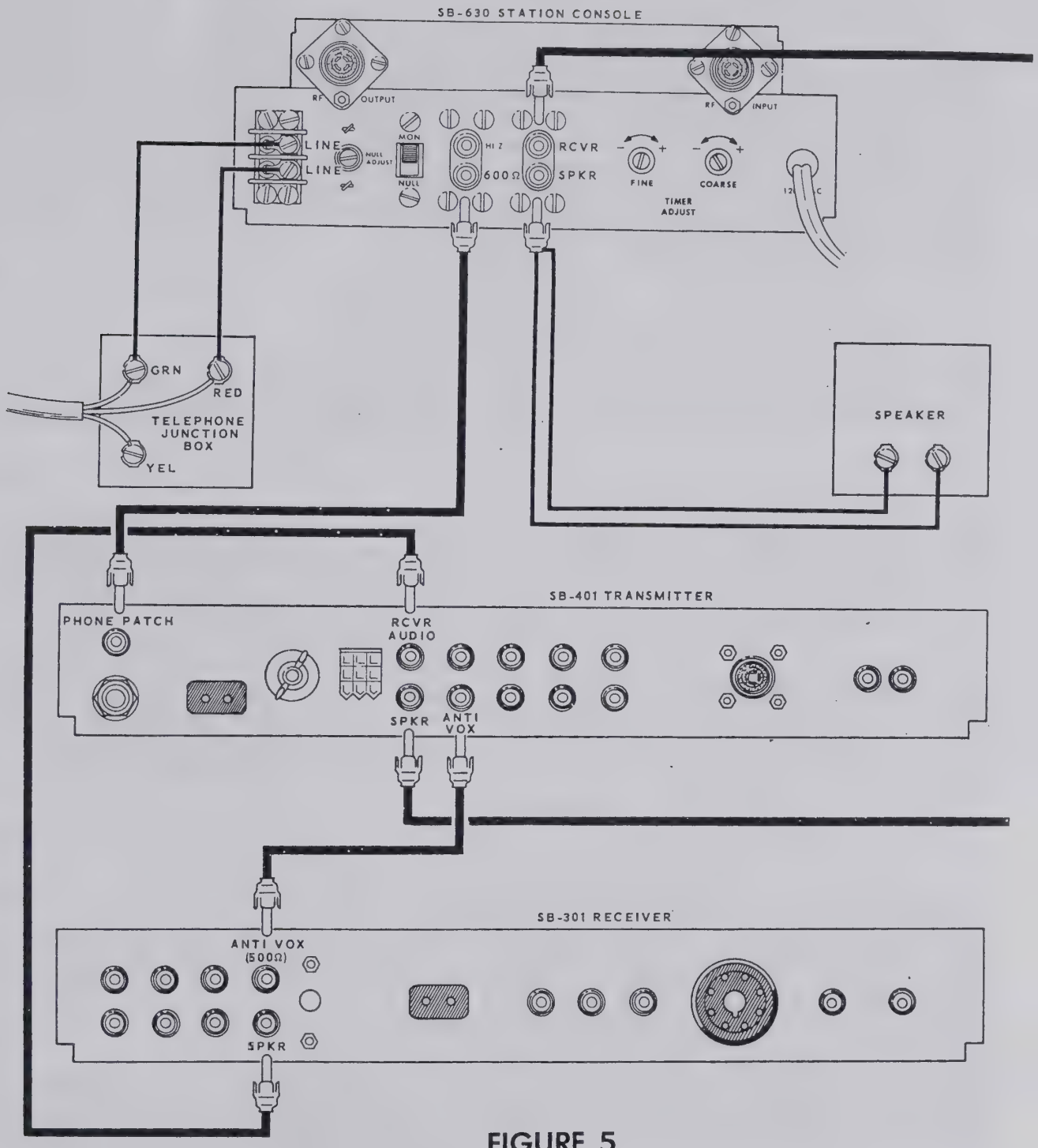

SB-630 STATION CONSOLE
RF OUTPUT
RF INPUT
LINE
LINE
NULL ADJUST
MON
NULL
HI Z
600Ω
RCVR
SPKR
FINE
COARSE
TIMER ADJUST
GRN
RED
YEL
TELEPHONE JUNCTION BOX
SPEAKER
SB-401 TRANSMITTER
PHONE PATCH
RCVR AUDIO
SPKR
ANTI VOX
SB-301 RECEIVER
ANTI VOX (500Ω)
SPKR

FIGURE 5

INSTALLATION AND OPERATION

The digital electric clock, the ten-minute timer, the SWR meter, and the phone patch, are independent sections within the Station Console. The installation and operation of each of these sections will be presented separately. Figure 1 (fold-out from Page 26) shows the location of front panel controls and switches. Figure 2 shows the connectors, jacks, controls, and switch located on the rear of the chassis.

DIGITAL ELECTRIC CLOCK

Installation

No special installation of the clock is required, since it runs whenever the line cord is connected to a 120 volt 60 Hz AC power line.

Operation

To set the clock, rotate the numbered minute and hour drums until the correct time appears in the window of the escutcheon. Do not move the drums when the seconds indicator is near 60. If you desire to set the seconds drum to an accurate time standard (National Bureau of Standards station WWV, for example), disconnect the line cord from the AC power line and wait for the time standard seconds to match the seconds indicated on the clock. Then plug in the line cord and set the minute and hour drums as before.

TEN-MINUTE TIMER

Installation

Connect the line cord to a 120 volt 60 Hz AC power line. The ten-minute timer requires no other installation.

Operation

Turn the TIMER switch to either VISUAL or AURAL. The neon pilot lamp will indicate that the timer is on. Press the RESET button. After a time interval of approximately ten minutes, slowly turn the Coarse control until the IDENTIFY window in the escutcheon lights. The IDENTIFY window will light and the buzzer will sound when the TIMER switch is in the AURAL position.

NOTE: The timer measures an interval that begins when the RESET button is pressed, or when the TIMER switch is turned from Off to either VISUAL or AURAL. To increase the timing interval, turn the TIMER ADJUST controls clockwise. To decrease the interval, turn the controls counterclockwise. The Coarse control permits you to adjust the time interval to within a minute, and the Fine control allows adjustment to within seconds of the desired interval.

The timed interval repeats automatically after the IDENTIFY window lights or the buzzer sounds. The time interval will restart at any time during the cycle if the RESET button is pressed.

When the timer is used with an amateur station, it is a good practice to press the RESET button at the beginning of a transmission. The IDENTIFY light or the buzzer will remind the operator to give his station identification, or call letters, every ten minutes.

The TIMER switch can be left in the OFF position when the timer is not in use, since the ten-minute timer has no effect on the SWR meter or phone patch sections of the Console.

SWR METER

Installation

The SWR meter section of the Console connects between the transmitter output and the antenna transmission line with standard coaxial connectors. The meter can be used with either 50-52 Ω or 70-75 Ω transmission lines, depending on the values of resistors R1 and R2 that were installed in the SWR bridge during assembly. The meter will not perform properly in transmission lines of other impedance, or with lines that are used as tuned feeders. No AC power is needed to operate the SWR meter.

( ) Cut the coaxial transmission line at a place that will allow the Console to set at a convenient location. Install male coaxial connectors on the cable ends.

( ) Connect the transmitter output cable to the RF Input connector and connect the antenna cable to the RF Output connector on the rear of the Console. See Figure 2.

NOTE: If an antenna tuner is used, connect the SWR meter between the transmitter and the antenna tuner with coaxial cable of proper impedance. Then the tuner can be adjusted for maximum output and minimum standing wave ratio.

Operation

Before you apply power to the transmitter, turn the MODE switch to SWR METER, the SWR METER switch to FWD, and the SENSITIVITY control to MIN.

1. Turn on the transmitter and tune it. Disregard any SWR Meter readings during transmitter tuning.

2. After the transmitter is tuned, and with power still applied, set the SENSITIVITY control for a midscale reading on the SWR meter.

NOTE: You may wish, at this time, to "touch up" the tuning of the transmitter. If this "touch up" increases your output, as shown by an increase in the SWR meter reading, you will have obtained a closer match between the transmitter and the transmission line.

3. Set the SENSITIVITY control to give a full-scale (SET) meter reading.

4. Turn the SWR METER switch to REV. The standing wave ratio (SWR) can now be read directly on the meter.

NOTE: The SWR meter can be switched between FWD and REV during transmission and no switching transient will result, since the switch is connected in a low-power bridge circuit. The SWR meter may be left connected in the transmission line at all times for continuous monitoring purposes.

Normal Operating Characteristics

The minimum transmitter output power that is needed to operate the SWR meter varies with frequency. 70 watts are needed for full-scale deflection on 75 meters with the SWR METER switch in the FWD position, while only 2 or 3 watts are required for full-scale deflection on 6 meters. At low power levels where full-scale deflection cannot be obtained, the reflected power indicated with the switch in the REV position will be approximately proportional to the ratio between the actual and full-scale FWD meter readings. For example, if the transmitter output power will only drive the meter to 70% of full scale, then the SWR that you read on the meter in the REV position will only be 70% of the actual SWR in your transmission line.

As the transmitter is voice modulated, the meter will deflect downward slightly. This will occur when the SWR METER switch is in the FWD position; it should not be confused with downward modulation. This effect is generally due to a nonlinear relationship between the voltage and current in the final amplifier of the transmitter, and should not alarm the operator since it is entirely normal with high level modulation.

Control carrier modulation will "kick" the meter indication upward on peaks. SSB and DSB signals will give a bouncing indication when transmitting, so no SWR measurement can be made. Therefore, use a single-tone or CW carrier with sideband transmitters when taking readings. When operating SSB, any meter indication with no modulation indicates spurious or parasitic emission, or poor carrier suppression.

Physical Placement and Losses

The meter readings may vary if the SWR meter is placed at different locations in the transmission line, or if the length of the transmission line is changed. For this reason, assume that the highest SWR reading is most correct. Keep in mind that the closer the SWR approaches 1:1; the more accurate the SWR meter becomes.

Misleading meter readings may be obtained with long transmission lines, since the losses in the cable tend to "smooth out" the standing waves. This condition may give you a much better indication at the transmitter than actually exists at the antenna. Therefore, if you are using a transmission line long enough to have appreciable losses, locate the SWR meter near the antenna, especially when adjusting beams or tuning traps. You can better understand the extent of this effect when you realize that a line with a 3 db loss will show a SWR of 3 when it is terminated in a dead short. A line with a loss of over 10 db will show a SWR of practically 1:1, on this or any other SWR meter, regardless of what load or termination is connected at the far end.

The power losses in these cases occur in the cable, but the SWR meter reading will not indicate that anything is wrong. When in doubt, make measurements at the antenna and at the transmitter, so future changes in the readings will be meaningful. The values of cable losses at various frequencies can be obtained from Figure 3. These losses become worse as time and moisture affect the cable.

With a high SWR, the transmission line losses may become so great that the radiated power is appreciably reduced; with high-power transmitters, the cable ratings may be exceeded. Figure 4 shows the effect of increasing cable losses caused by various values of SWR. When these losses occur, the RF power is turned into heat in the cable instead of being radiated from the antenna.

To figure the total losses in a given length of coaxial cable, determine the db loss per foot of the cable from Figure 3. This is done by finding your operating frequency on the bottom line of the chart, and moving up to find the type of cable used. By looking at this same level on the left-hand side of the chart, you can read the db loss per 100 feet of the cable at that frequency.

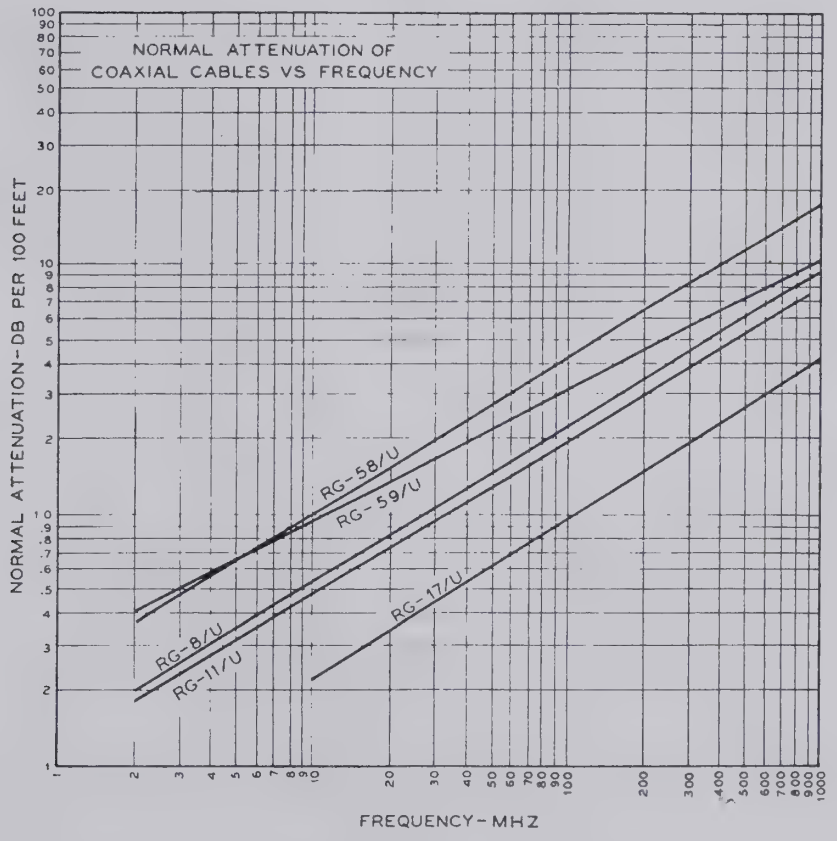


Figure 3

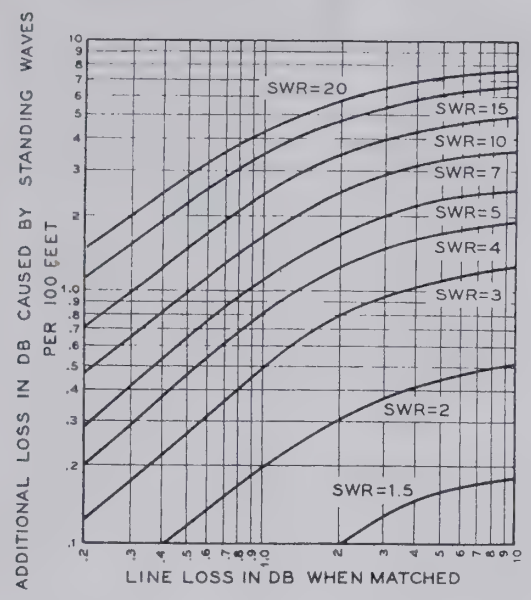


Figure 4

Now determine the additional loss caused by the SWR from Figure 4 as follows: Use the amount of loss determined from Figure 3 and find this value on the bottom line of Figure 4. Now move up the graph until you come to the SWR of your antenna system. Move over to the left-hand side of the graph and determine the amount of loss caused by the SWR. To obtain the total loss of your system, add the value from Figure 3 to the value from Figure 4.

Loading

The load presented to the transmitter output circuit may create conditions that make it touchy or impossible to load the transmitter. With a low SWR, the load that the transmitter "sees" is practically pure resistive. However, at a high SWR, the apparent load may change from a very low to a very high resistance, accompanied by either capacitive or inductive reactance. These resistance and reactance values change when the transmission line length or frequency is changed.

Remember when you are using 50-52 Ω or 70-75 Ω unbalanced feed lines, that the SWR cannot be changed by changing the transmission line length. However, the loading to the transmitter may be changed considerably, thus making it appear that "pruning" the cable length offers improvement, when it actually does not affect the SWR.

The SWR can only be changed by changing the load or termination at the end of the cable. If the transmission line length is changed, for example, with 50 Ω cable and a SWR of 3, the apparent load to the transmitter may vary from 16-2/3 Ω to 150 Ω resistive, with reactance varying from 66-2/3 Ω capacitive, to zero, to 66-2/3 Ω inductive. If the transmitter output tuning adjustments will not accomodate this impedance range, the transmitter will be difficult to load until the load is properly matched to the line. When the load is matched, the SWR will be lower.

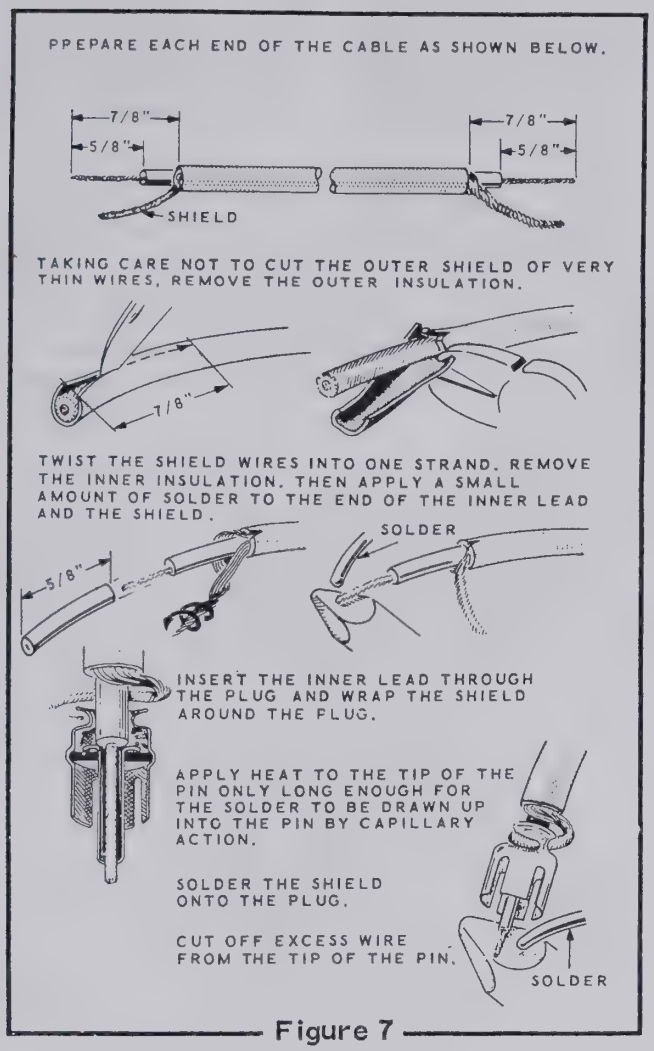

PPEPARE EACH END OF THE CABLE AS SHOWN BELOW.
7/8"
5/8"
SHIELD
TAKING CARE NOT TO CUT THE OUTER SHIELD OF VERY THIN WIRES, REMOVE THE OUTER INSULATION.
7/8"
TWIST THE SHIELD WIRES INTO ONE STRAND. REMOVE THE INNER INSULATION. THEN APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE INNER LEAD AND THE SHIELD.
5/8"
SOLDER
INSERT THE INNER LEAD THROUGH THE PLUG AND WRAP THE SHIELD AROUND THE PLUG.
APPLY HEAT TO THE TIP OF THE PIN ONLY LONG ENOUGH FOR THE SOLDER TO BE DRAWN UP INTO THE PIN BY CAPILLARY ACTION.
SOLDER THE SHIELD ONTO THE PLUG.
CUT OFF EXCESS WIRE FROM THE TIP OF THE PIN.
SOLDER

Figure 7

PHONE PATCH

Installation

HEATH SB SERIES OF EQUIPMENT

To illustrate installation of the Phone Patch a transceiver, a receiver-transmitter combination, and a speaker have been selected from the Heath SB series of amateur equipment. Use the shielded audio cable and the phono plugs supplied to interconnect the equipment as shown in Figure 5 (fold-out from Page 26) and Figure 6 (fold-out from Page 35). Refer to Figure 7 for the installation of phono plugs.

( ) If not previously done, install a phono plug on the end of the lead from your station speaker. Connect this plug to the SPKR socket on the near of the Console.

( ) Connect the SPKR terminal of the transmitter (may be marked "8 Ω" on transceivers) to the RCVR terminal on the back of the Console. Use the shielded cable provided. The shield wires will make the essential ground connection between the pieces of equipment.

( ) Connect the HI-Z phone patch output to the PHONE PATCH input of your transmitting equipment. Use shielded cable.

CAUTION: To prevent the telephone ringing voltage from damaging the VU meter, be sure the ON-OFF switch is turned to OFF before you connect any leads to the telephone line.

( ) Connect one of the two LINE terminals on the back of the Console to the red wire on the telephone terminal block, and the other LINE terminal to the green wire on the terminal block. Polarity is not important. Disregard the yellow wire on the terminal block.

EQUIPMENT OTHER THAN HEATH

Connections to other makes of equipment will vary in details, but the same basic principles will apply. Some notes and suggestions follow:

1. Use shielded wire for all audio interconnecting lines as an aid in the suppression of RF feedback. It is usually unnecessary to use shielded wire between the telephone terminal block and the Phone Patch.

2. If not already provided, arrangements should be made to mute your receiver and to open the SPKR lead when transmitting.

3. If you want to use voice control but no anti-vox output is provided on your receiver, use shielded wire to connect the Anti-Vox transmitter input to the SPKR and GND terminals on the back of the Phone Patch.

4. Usually the HI-Z Phone Patch output will be associated with transmitter grid input circuits and the 600 Ω connection with cathode input circuits. Try both for suitability. Figure 8 shows some suggested microphone and Phone Patch output connections to the first audio stage of your transmitter.

5. If one of the terminals of your speaker is connected to the metal speaker frame, or is grounded in some other manner, connect this terminal to the GND connection on the Phone Patch, and the other speaker terminal to the SPKR connection. If neither speaker terminal is grounded, polarity is unimportant.

6. Make sure that shield wires are properly grounded at both ends to the equipment which they connect and that, if necessary, a separate ground wire interconnects all equipment.

( ) Readjust the Vox and Anti-Vox controls on your transmitting equipment after connecting the Phone Patch.

Null Adjustment

NOTE: Null adjustment is required only when the phone patch is to be used with voice-control operation. If only manual operation is to be used, omit the following steps and proceed to the Operation instructions.

CAUTION: Never try to make the null adjustment without actually placing a phone call. The impedance of a dead line, obtained when dialing only one digit, is different from the line impedance when a completed call is made.

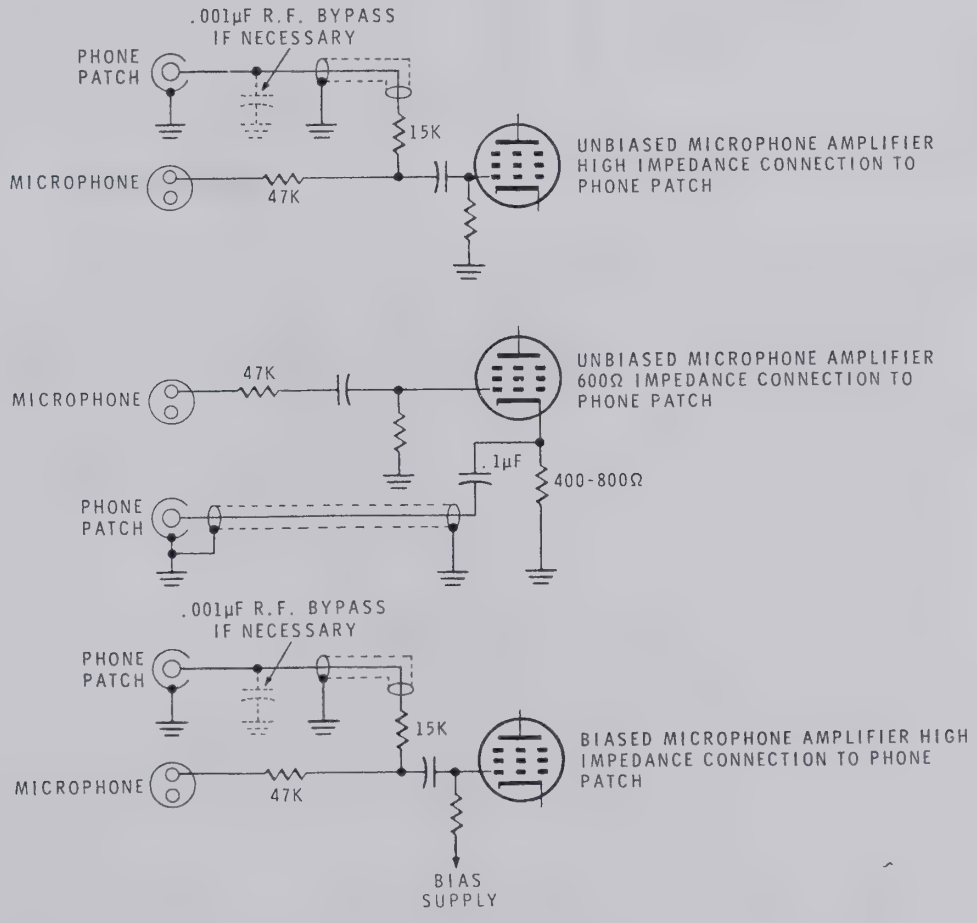
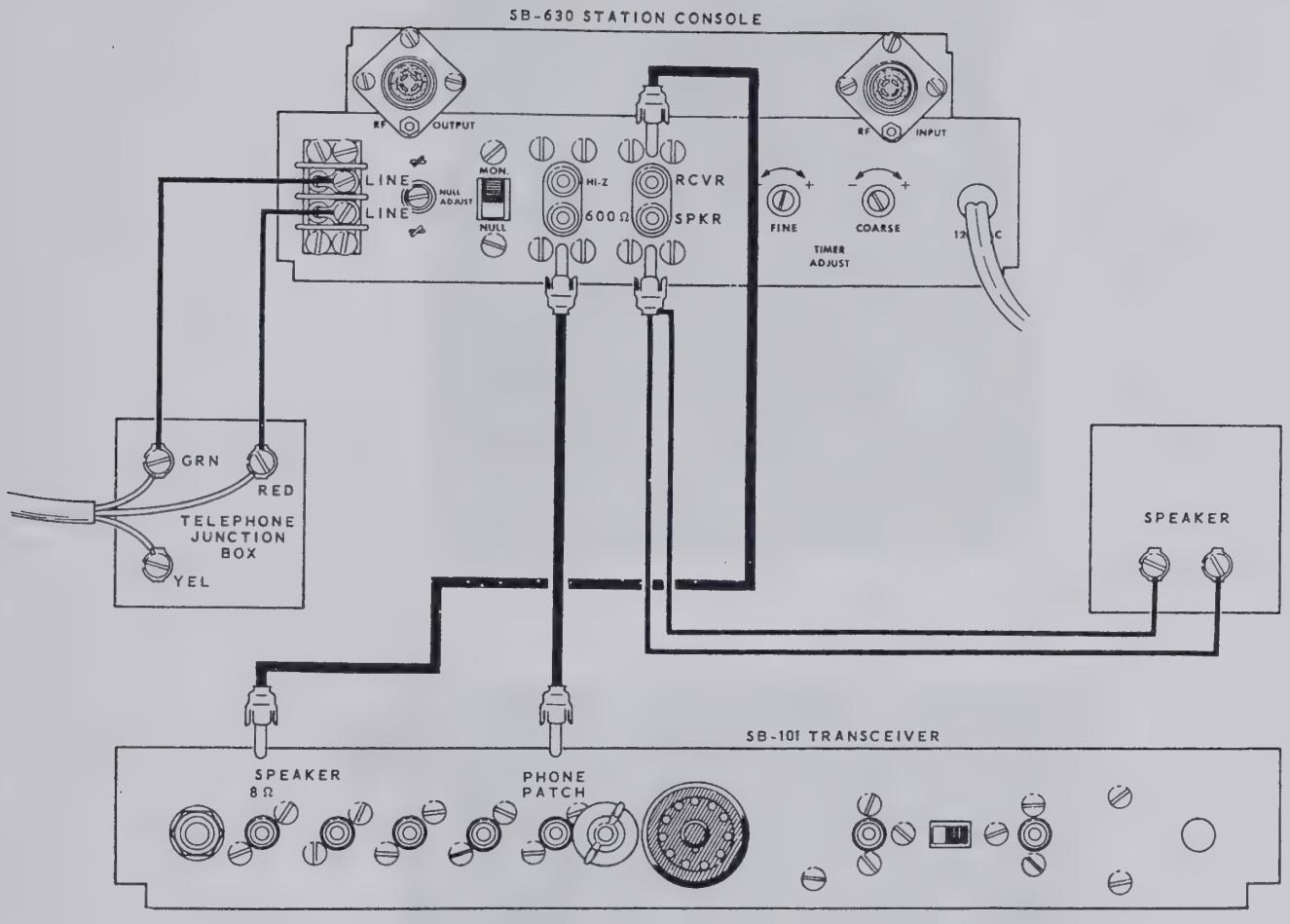


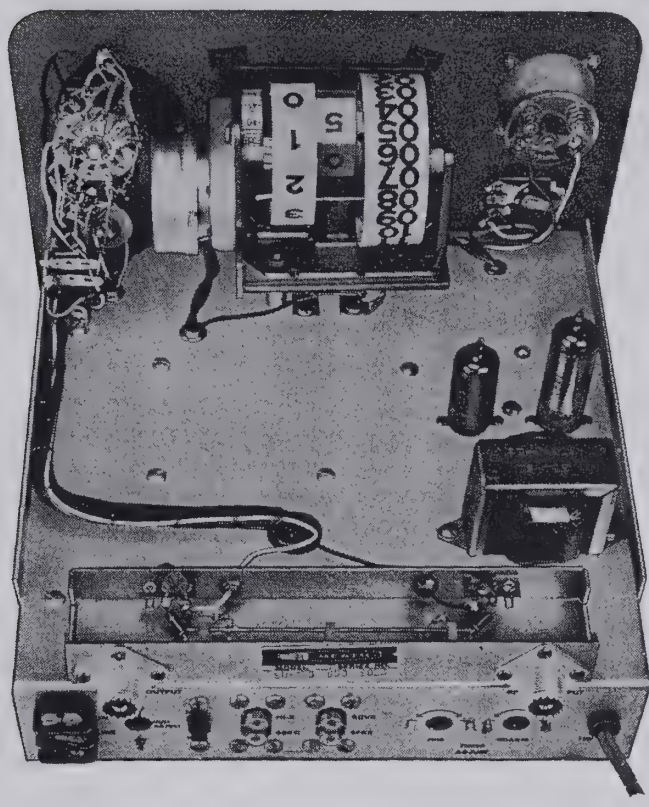
Figure 8

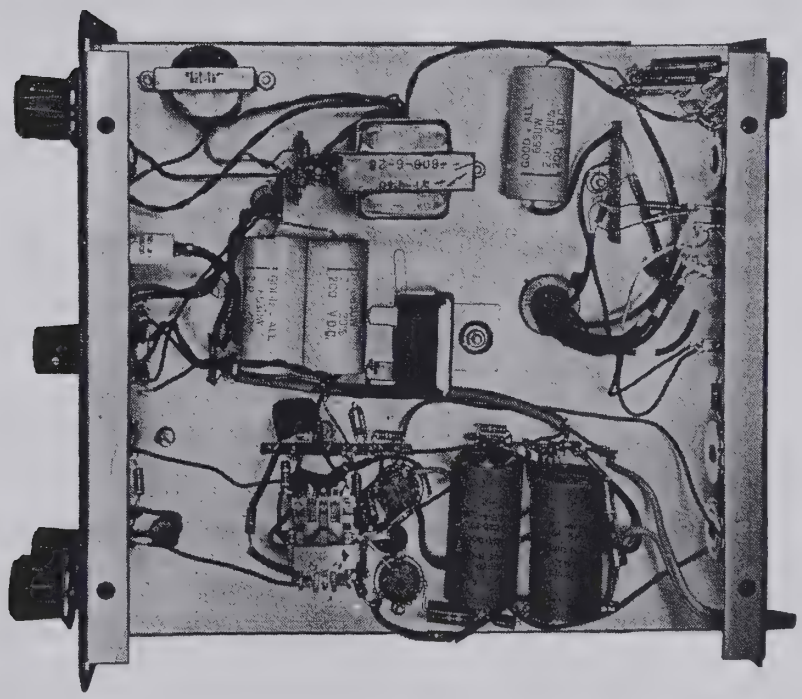


NOTE:
VOX AND ANTI-VOX ADJUSTMENTS ARE INTERIOR ON THE SB-100 AND SB-110 TRANSCEIVERS

FIGURE 6

CHASSIS PHOTOGRAPHS





(✓) Set the Console controls and switches as follows:

NULL-MON switch - NULL.
NULL ADJUST control - Full counterclockwise.
TRANS GAIN control - Full counterclockwise.
RCVR GAIN control - 2/3 clockwise.
MODE switch - SWR METER.

(✓) Tune in a strong heterodyne note of about 800 cps on the receiver. This can be done by beating a crystal calibrator against the receiver BFO.

(✓) Call a friend on the phone. Someone on a different line is best. Explain that there will be a strong tone in the telephone receiver, that he should keep the phone away from his ear, and that he can hang up when the tone stops.

(✓) Leave your telephone handset off the hook, and turn the MODE switch to PHONE PATCH.

(✓) Advance the receiver AF gain control until the VU meter on the Console indicates zero VU.

(✓) Adjust the NULL ADJUST control for a minimum VU meter indication, -20 or less. This dip should occur with about one-half rotation of the NULL ADJUST control.

(✓) Turn the MODE switch to SWR METER and hang up the telephone handset.

(✓) Place the NULL-MON switch in the MON position.

This completes the Null Adjustment of the phone patch.

Operation

The phone patch can be left connected at all times. When the MODE switch is in the SWR METER position, the phone patch is isolated from the telephone line. Use the phone patch in the following manner.

1. Be sure the MODE switch is turned to SWR METER; then dial the desired phone number.

2. When the called party answers, explain the procedure for speaking over a phone patch. Then turn the MODE switch to PHONE PATCH.

NOTE: When the NULL-MON switch is in the MON position, the VU meter indicates the listening level on the telephone lines. The telephone industry permits peaks up to zero VU. In testing the phone patch we have found that this level was much in excess of a comfortable listening level. The exact level will have to be determined by experimentation; however -10 VU seems to be satisfactory in most cases. NEVER PERMIT THE LEVEL TO EXCEED ZERO VU, AS IT MAY CAUSE CROSSTALK BETWEEN TELEPHONE CHANNELS.

3. Adjust the TRANS GAIN control to provide the desired modulation level, and adjust the RCVR GAIN to provide the desired listening level. It is not necessary to change the AF gain controls on the Receiver and Transmitter.

4. It is not necessary to switch the phone patch when changing from transmit to receive. The operator can use the telephone handset for a microphone and headset. When the phone patch call is completed, always turn the MODE switch to SWR METER.

Troubleshooting Chart

This Chart is divided into the following four parts; Clock Circuit, Timer Circuit, SWR Meter Circuit, and phone patch circuit.

CLOCK CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
Clock does not run.	1. Line cord not connected. 2. Fuse blown. 3. Seconds dial drum rubbing against escutcheon window. 4. Faulty wiring of clock leads to AC power circuit.

TIMER CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
Tube V1 (6EW6) filament not lit.	1. Timer switch in OFF position. 2. Filament burned out. 3. Tubes V1 and V2 in wrong sockets. 4. Faulty wiring of filament circuit.
No Identify light when Reset button is pressed; buzzer sounds when Timer switch is in Aural position.	1. #47 pilot lamps burned out. 2. Faulty wiring of pilot lamps or Timer switch circuits. 3. Faulty Timer switch.
Buzzer does not sound when Reset button is pressed if Timer switch is in Aural position.	1. Faulty wiring of buzzer or Timer switch circuits. 2. Faulty Timer switch.
Neither buzzer nor Identify lights operate when Reset button is pressed.	1. Timer switch in Off position. 2. Dirty or faulty relay contacts 5 and 7. 3. Faulty Reset pushbutton switch. 4. Open 33 KΩ resistor R29. 5. Faulty Timer switch or its wiring.
Identify lights and/or buzzer comes on when TIMER switch turned from Off position.	1. Tube V1 (6EW6) shorted. 2. Neon lamp NE2 shorted. 3. Faulty circuit wiring.

DIFFICULTY	POSSIBLE CAUSE
Identify light or buzzer does not signal ten minute interval.	1. Tube V1 (6EW6) weak or dead. 2. Capacitors C21, C22, C23, or C24 faulty. 3. Resistors R22, R24, R25, R26, or R37 open. 4. Faulty diodes D5 or D6. 5. Dirty or faulty relay contacts.

NOTE: Voltage checks in the electronic circuits, when compared with the voltages shown on the Schematic, may help you locate difficulties in the ten-minute timer.

SWR METER CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
No meter reading when transmitting.	1. Mode switch in Phone Patch position. 2. Diode D1 or D2 open. 3. Jumper wire still connected across meter terminals.
Meter deflects backward when transmitting.	1. Diode D1 or D2 installed backward. 2. Meter wires reversed.
Low meter reading when transmitting.	1. SWR Meter switch in REV position. 2. Sensitivity control incorrectly set. 3. Insufficient transmitter power. 4. Resistor R1 or R2 open or wrong value. 5. Capacitor C1 or C2 faulty.

PHONE PATCH CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
No meter reading when receiving.	1. RCVR gain control improperly adjusted. 2. Null-Mon switch in Null position. 3. Diode D3 faulty. 4. Resistor R4 open. 5. RCVR and SPKR plugs transposed.
Poor transmitter gain.	1. Null-Mon switch in Null position. 2. TRANS gain control improperly adjusted. 3. Wrong output impedance used.
Deep null not obtained.	1. Phone dialing not completed. 2. Null Adjust control improperly set.
No transfer of audio between telephone lines and station equipment.	1. Mode switch in SWR Meter position. 2. RCVR and TRANS gain controls improperly adjusted. 3. Resistor R6, R7, R9, or R11 open. 4. Transformers T1 and T2 incorrectly wired.

SPECIFICATIONS

CLOCK

Dial	4-drum, 24-hour, digital readout.
Motor	1 rpm at "seconds" drum; gear driven.
Power Requirements	120 VAC, 60 Hz, 3.7 watts. (Internally connected to Console AC line cord.)

TIMER

Time Interval	Adjustable to 10 minutes.
Time Stability	Less than .2 percent change per hour in normal ambient temperature.
Time Cycle	Instant reset with front panel pushbutton.
Signal	Visual or both visual and aural; switch selected from front panel, with Off position.
Circuit	Resistance-capacitance network. Neon-discharge, vacuum tube relay control.
Tube Complement	6EW6 Relay control. OA2 Voltage regulator.
Power Supply	Transformer operated, voltage regulated, fused.
Power Requirements	120 VAC 60 Hz, 15 watts.

SWR METER

Operation	Indicates percentage of forward and reflected power, and voltage standing wave ratio (SWR).
RF Power Handling Capability	2 kilowatts P.E.P.
Input And Output Impedance	50-52 Ω or 70-75 Ω.
Band Coverage	160 through 6 meters.

PHONE PATCH

Circuit	Telephone hybrid circuit. Allows voice control or manual operation. Single switch places unit in full operation.
Telephone Line Input Impedance	Approximately 600 Ω.
Null Depth	At least 30 db isolation between transmit and receive circuits.
Receiver Impedance	Effective match from 3 to 16 Ω.
Transmitter Impedance	600 Ω or high impedance output.

GENERAL CONSOLE SPECIFICATIONS

Meter	100 Microampere movement. VU readings for phone patch monitoring and null depth indication. Relative power and standing wave ratio readings for SWR meter.
Front Panel Controls	Mode: SWR Meter, Phone Patch. Timer: Off, Visual, Audio. Reset: Pushbutton. SWR Meter: Forward, Reverse. SWR Meter: Sensitivity. Phone Patch: Transmitter gain. Phone Patch: Receiver gain.
Rear Panel Controls	Timer Adjust. Null Adjust. Null - Monitor switch.
Dimensions	6-5/8" high x 10" wide x 11-1/8" deep (including knobs).
Net Weight	7-1/2 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 43) while you read this Circuit Description.

The Station Console contains the following independent circuits, which will be described separately: the Clock and Timer Circuit, the SWR Meter Circuit, and the Phone Patch Circuit. A review of the Installation And Operation section of this Manual will also help you understand the function of the circuits.

CLOCK AND TIMER CIRCUIT

The digital readout clock motor is connected to the AC power line through a 3/16 ampere slow-blow fuse. The clock runs continuously when the line cord is connected to a source of 120 V 60 Hz alternating current.

The timer circuit begins to operate when the Timer switch is turned from Off to either Visual or Aural. The neon pilot lamp indicates when the timer is on.

Power for the timer circuit is obtained from transformer T3, through the voltage doubling and filtering network of diodes D4 and D5 and capacitors C26 and C27. Transformer T3 also supplies 6.3 volts AC for the filament of tube V1, for signal buzzer L3, and for the #47 pilot lamps.

Tube V2 is a voltage regulator which keeps the DC supply voltage at a constant level, and resistor R38 is the limiting resistor for the regulator tube.

Resistors R24, R25, and R26 and capacitors C23 and C24 form an RC network with a very slow charging rate. The capacitors charge slowly through the resistors until the potential across the neon discharge lamp is sufficient to cause the lamp to conduct. When the lamp conducts, a positive pulse is sent through capacitor C22 to the grid of V1. The potential across the neon discharge lamp is governed by the setting of the Timer Adjust controls, which are in the voltage divider circuit of R34, R35, R36, and R37, and series resistor R33.

The positive pulse that is applied to the grid of V1 causes the tube to conduct and pass current through resistor R31 and the coil of the relay. With the relay coil energized, contacts 5 and 7 close to apply 6.3 VAC to the #47 pilot lamps (and to buzzer L3).

When relay contacts 1 and 9 close, capacitor C25 discharges through resistors R32 and R27 to hold the grid positive (and hold the relay closed) for approximately one second. The values of resistors R27 and R32, in series with capacitor C25, determine the length of time required for C25 to discharge. Thus, a higher resistance for R27 would increase the time that the relay would remain closed and the identify window lit. Contacts 2 and 9 of the relay had caused capacitor C25 to charge from the power supply before the relay closed.

While the relay coil is energized, contacts 3 and 8 close to discharge capacitors C23 and C24 through resistor R28; then the timing cycle begins again.

When the Reset button is pressed, current flows from the power supply, through the relay coil, the Reset button contacts, and resistor R29 to ground. This energizes the relay coil to close the relay contacts and restarts the timing cycle.

SWR METER CIRCUIT

The SWR Meter circuit is based upon the circuit of a device developed at the U.S. Naval Research Laboratory, Washington, D.C., and described in N.R.L. report No. 3538, titled "A Reflectometer for H-F Band." Simplified versions have also been described in various amateur radio publications.

The SWR meter consists of a short section of transmission line to which two small linear inductors are coupled, both inductively and capacitively. The radio frequency current flowing in each inductor and its load resistor is rectified by a germanium diode and filtered by a ceramic capacitor. Because L1 is terminated at the output and L2 is terminated at the input, the rectified current in L1 indicates forward relative power, while the rectified current in L2 indicates reverse relative power. The SWR Meter switch selects the direct current output of either diode and applies it to a variable-sensitivity metering circuit, consisting of a linear potentiometer and a microammeter.

The Mode switch connects the meter to the output of the sensitivity control in the SWR Meter position, and the meter indicates reflected power, or SWR. In the other position, the Mode switch is connected to the Phone Patch circuit which will be described next.

PHONE PATCH CIRCUIT

The phone patch circuit is based on the use of special hybrid transformer T1. The hybrid transformer with proper adjustment of the Null-Adjust control, will provide a high degree of isolation between the receiving and transmitting circuits. This feature is required for stable voice-control operation.

The operation of a hybrid transformer is shown in Figures 9 and 10. Refer to the Schematic Diagram (fold-out from Page 43) while reading this Description.

Figure 9 shows the phone patch in the Transmit cycle; that is, energy from the telephone line is being routed to the transmitter. The turns ratio of the hybrid transformer is such that the impedance of windings C, D, and Z_T are equal. If voltage E (representing an incoming voltage of the telephone line) is impressed on the transformer, it will at a given instant, cause current to flow as shown by the arrows. The opposing voltage drop across winding C will equal that across winding Z_T. Identical winding D is linked by the same flux as winding C; therefore it will have an induced (opposing) voltage of equal magnitude and in the same direction as winding C. The induced voltage in winding D is equal to the voltage across winding Z_T, and since their like polarities are connected together, no current flow will occur through Z_B. The result is that one-half of the incoming energy is available at the transmitter input and the other half is dissipated across Z_R.

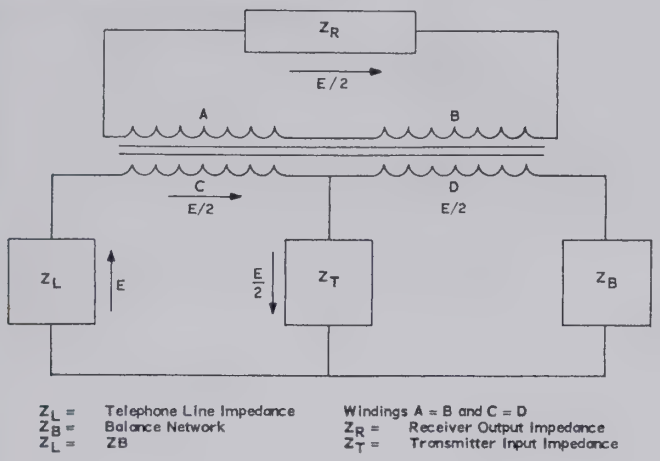


Figure 9

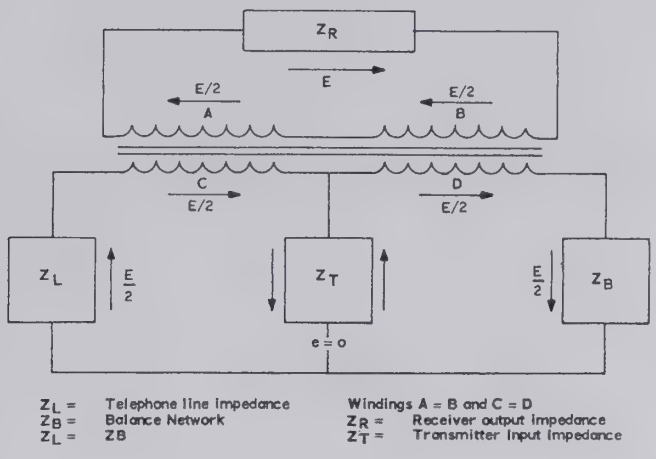


Figure 10

In Figure 10, the phone patch is shown in the receive cycle, with the signal from the receiver routed to the telephone line. If voltage E (representing a voltage from the receiver) is impressed on the transformer, it will, at a given instant, cause current to flow as shown by the arrows. Windings A and B are connected in series aiding.

Equal voltages are induced in each winding, since winding C equals winding D. The balance network is adjusted so that Z_B equals Z_L, therefore the voltage drops across Z_B and Z_L are equal. This will cause equal and opposite currents through Z_T, so there is no voltage across Z_T and no energy is fed to the transmitter input.

The turns ratio of the transformer windings (T1 and T2) match the speaker and transmitter input impedances to the hybrid windings of transformer T1.

The phone patch circuit, and the meter, are coupled to the telephone line when the Mode switch (S3) is turned to the PHONE Patch position. The meter, coupled through resistors R4 and R5 and diode D3, closely approximates standard VU readings. A zero VU reading represents 4 db above 1 milliwatt in 600 Ω, and is the maximum voltage allowed on the telephone lines to avoid crosstalk between channels.

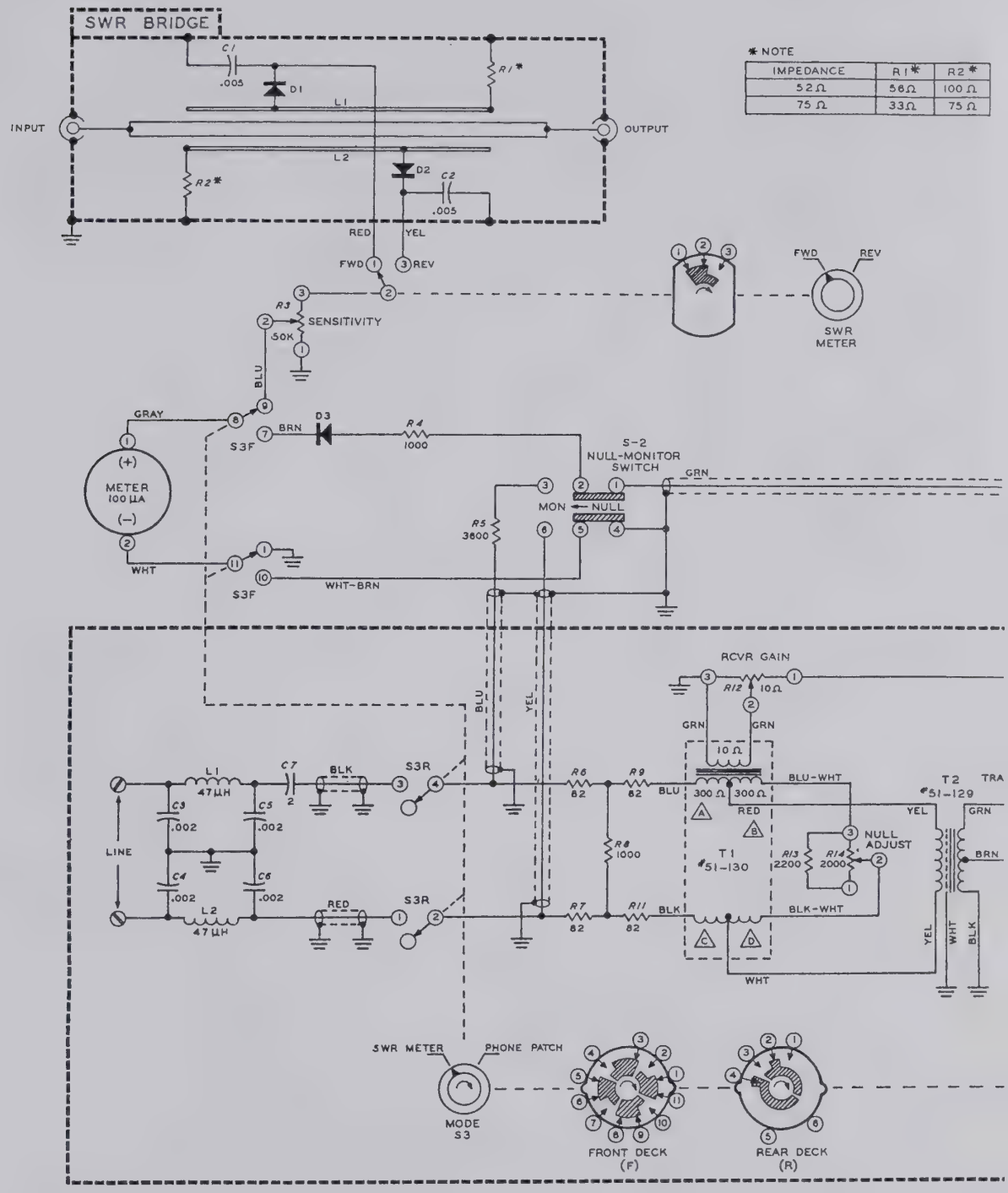
A Null-Monitor switch, S2, is provided on the rear apron so the VU meter can be used as a null indicator when the balance network is adjusted. In the Null position of S2, resistor R5 is switched out of the circuit to increase the sensitivity of the meter.

The telephone line connections to the phone patch are filtered by a balanced pi network to prevent RF from entering the phone lines and/or the transmitter audio circuits.

Since the impedance of telephone lines vary greatly from installation to installation, it is necessary to isolate the line impedance so a simple balance network will provide a sufficient null at every installation. This is accomplished by connecting the telephone line to the phone patch through an H pad. This H pad, which is formed by resistors R6, R7, R8, R9, and R11, has an impedance of 600 Ω. The pad forces the line impedance to appear as approximately a 600 Ω resistance. This allows the impedance of Null Adjust control R14 with resistor R13 to equal the line impedance and provide a deep null.

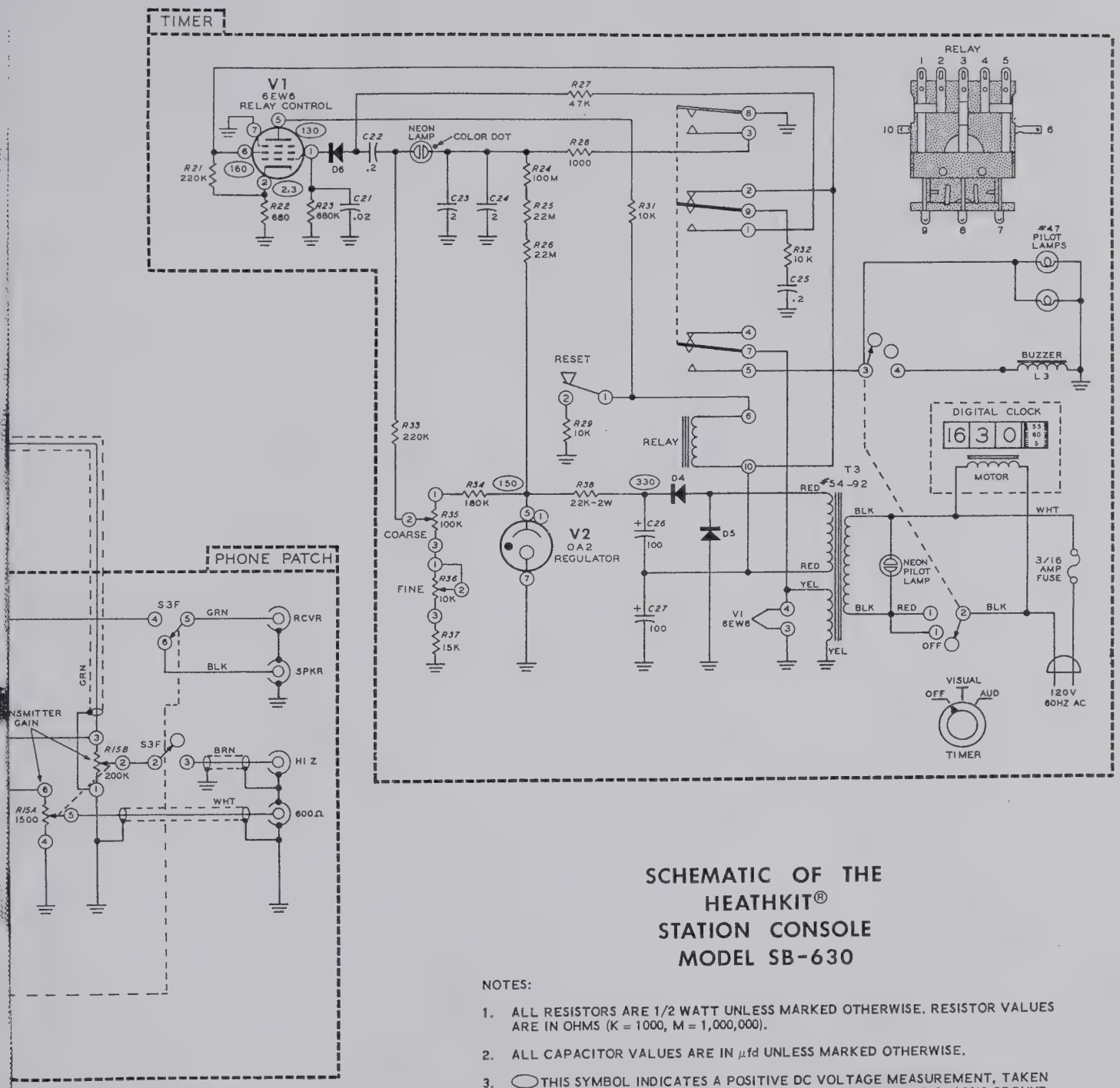
In order to provide a balanced load to the telephone line, an important feature in minimizing hum, the hybrid transformer incorporates additional windings, and the resistive pad is made in the "H" form.

The telephone line is also connected to the phone patch through capacitor C7. This capacitor blocks the DC voltage of the telephone line but allows the audio frequencies to pass. The large value of capacitance has very little reactance at audio frequencies, thus allowing the phone patch to maintain good audio quality.



* NOTE

IMPEDANCE	R1*	R2*
52Ω	56Ω	100Ω
75Ω	33Ω	75Ω



SCHEMATIC OF THE HEATHKIT® STATION CONSOLE MODEL SB-630

NOTES:

1. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K = 1000, M = 1,000,000).
2. ALL CAPACITOR VALUES ARE IN μfd UNLESS MARKED OTHERWISE.
3. ⬭ THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT, TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±10%.
4. ALL SWITCH WAFERS SHOWN IN FULL COUNTERCLOCKWISE POSITION, AS VIEWED FROM THE KNOB END OF THE SHAFT.

PRICE $2.00

HEATHKIT®
ASSEMBLY MANUAL

STATION CONSOLE
SB-630

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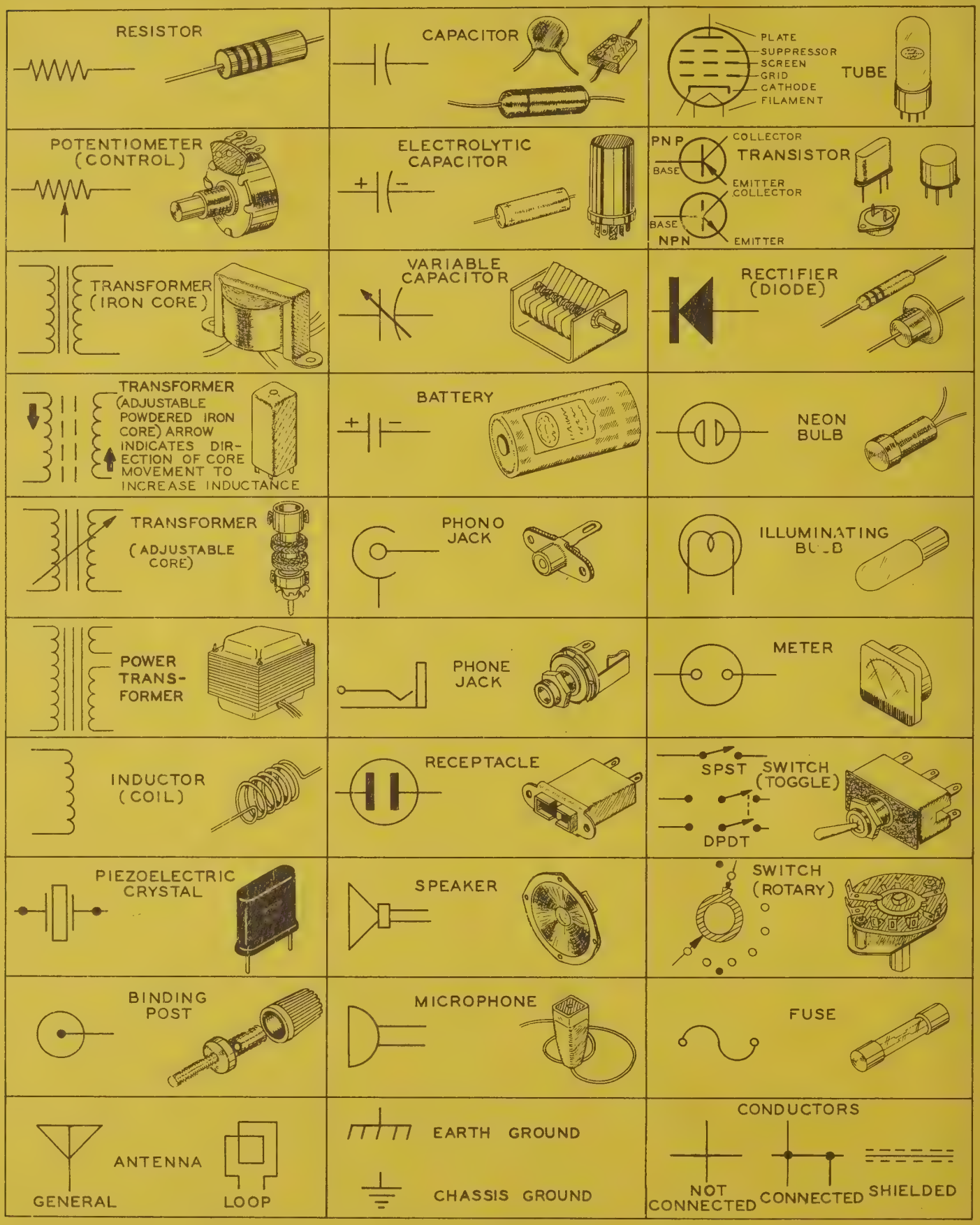
TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.



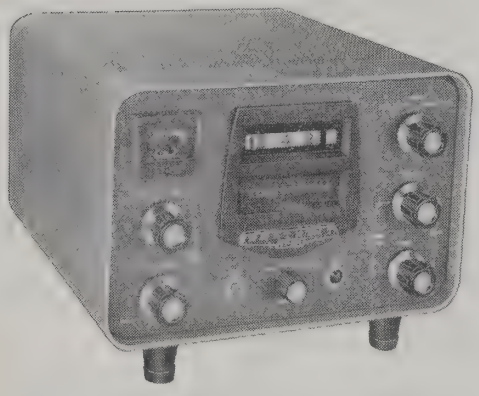
SER# 930-3349

Assembly
and
Operation
of the

HEATHKIT

STATION CONSOLE

Model SB-630



HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

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INTRODUCTION

The Heathkit Model SB-630 Station Console is a multipurpose instrument that includes an SWR (standing wave ratio) meter, a hybrid phone patch, a ten-minute timer, and an accurate digital readout clock. The Console was designed for use with an amateur radio station, or with other types of transmitters or transceivers.

The SWR meter section of the Console indicates the power transfer efficiency between a transmitter and antenna. If it is used with a transceiver, it will not affect receiver operation. The combination of very low insertion loss and high power rating permits the SWR meter to remain permanently inserted in a 50-52 Ω or 70-75 Ω transmission line. This permits constant monitoring of reflected power or SWR to determine proper transmitter tuning, transmission line-to-antenna impedance matching and relative power output.

The SWR meter section can also be used for other applications, such as testing the design of antenna coupling networks, checking other transmission systems, etc. The input and output connectors are standard SO-239 coaxial connectors.

The hybrid phone patch section of the Console is used to transfer audio signals between telephone lines and two-way radio equipment. It can be used either manually or with voice-control-operated (VOX) transmitters, without changing any connections.

When the phone patch section of the Console is used, the meter will indicate the VU level so you can monitor the phone patch output. This assures you that you are supplying the proper volume level to the telephone line so cross-talk is prevented. The meter also permits you to make a convenient null adjustment check (maximum null depth produces maximum isolation between the telephone line and station equipment, resulting in the best operating conditions for voice-control circuits). Proper match to the telephone line, with minimum hum, is provided by a specially designed hybrid transformer.

The ten-minute timer in the Console reminds you to give your call letters and identify your station at ten minute intervals, to comply with FCC (Federal Communications Commission) regulations. Either a visual reminder, or both visual and aural reminders, can be selected by a switch on the Console front panel. The timer can be reset at any time to start a new ten minute interval.

The electric clock has a digital readout dial which shows the hour, minute, and second. The clock is independent of all other circuits in the Console, and runs whenever the power cord is connected to the AC line.

The SWR meter and the hybrid phone patch require no AC power for operation. They can be used with the timer switch turned off or with the line cord disconnected. AC power is required for operation of the ten-minute timer and for the electric clock.

The styling of the Model SB-630 Station Console matches that of other Heathkit SB-series equipment, and its versatility makes it a useful instrument for any amateur or other radio station.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

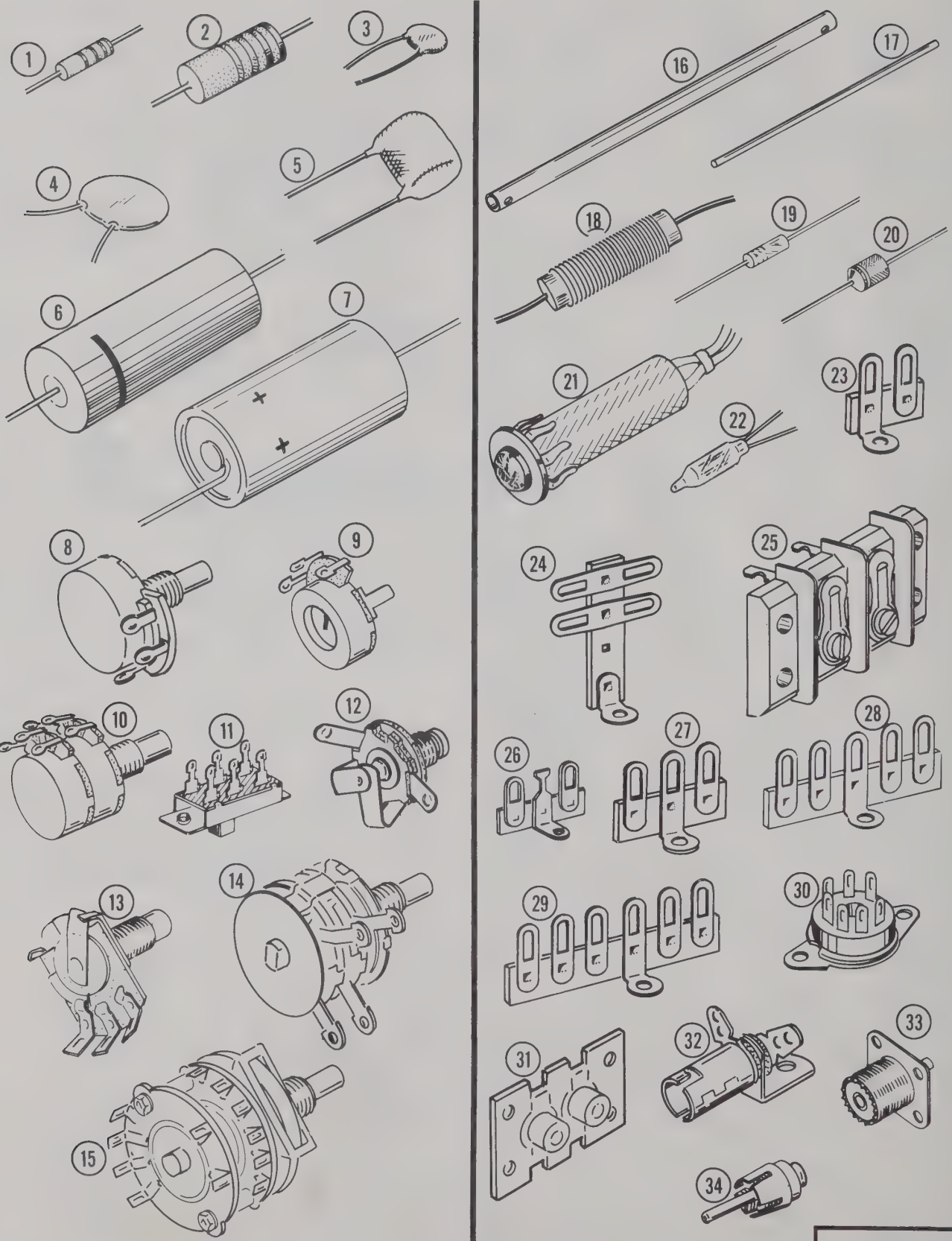
PARTS LIST

The numbers in parentheses in the Parts List are keyed to the numbers on the Parts Pictorial (fold-out from this Page).

PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS		
1/2 Watt		
(1) 1-103	1	33 Ω (orange-orange-black)
1-83	1	56 Ω (green-blue-black)
1-146	1	75 Ω (violet-green-black)
1-118	4	82 Ω (gray-red-black)
1-123	1	100 Ω (brown-black-brown)
1-7	1	680 Ω (blue-gray-brown)
1-9	3	1000 Ω (brown-black-red)
1-44	1	2200 Ω (red-red-red)
1-82	1	3600 Ω (orange-blue-red)
1-20	3	10 KΩ (brown-black-orange)
1-21	1	15 KΩ (brown-green-orange)
1-25	1	47 KΩ (yellow-violet-orange)
1-126	1	180 KΩ (brown-gray-yellow)
1-29	2	220 KΩ (red-red-yellow)
1-34	1	680 KΩ (blue-gray-yellow)
1-70	2	22 megohm (red-red-blue)
1-139	1	100 megohm (brown-black-violet)
2 Watt		
(2) 1-11-2	1	22 KΩ (red-red-orange)
CAPACITORS		
(3) 21-36	4	.002 μfd disc
21-27	2	.005 μfd disc
(4) 21-31	1	.02 μfd disc
(5) 27-34	2	.2 μfd resin
(6) 27-21	3	2 μfd tubular
(7) 25-57	2	100 μfd electrolytic
CONTROLS		
(8) 11-64	1	10 Ω wire-wound
10-11	1	50 KΩ
(9) 10-52	1	2000 Ω tab-mount
10-57	1	10 KΩ tab-mount
10-58	1	100 KΩ tab-mount
(10) 12-68	1	1500 Ω and 200 KΩ dual

PART No.	PARTS Per Kit	DESCRIPTION
SWITCHES		
(11) 60-2	1	DPDT slide
(12) 64-7	1	SPST pushbutton
(13) 63-177	1	2-position rotary
(14) 63-189	1	3-position rotary
(15) 63-428	1	2-section rotary
COILS-CHOKE-TRANSFORMERS		
(16) 40-98	1	RF driver element
(17) 40-99	2	RF pickup element
(18) 45-2	2	47 μH RF choke
51-129	1	Input transformer
51-130	1	Hybrid line transformer
54-92	1	Power transformer
DIODES-TUBES-LAMPS-FUSE		
(19) 56-26	4	1N191 germanium diode (brown-white-brown)
(20) 57-27	2	Silicon diode
411-59	1	OA2 tube
411-170	1	6EW6 tube
(21) 412-10	1	Snap-in neon lamp
(22) 412-34	1	Neon lamp
412-20	2	#47 pilot lamp
421-40	1	3/16 ampere slow-blow fuse
TERMINAL STRIPS		
(23) 431-16	1	2-lug
(24) 431-28	2	2-lug vertical
(25) 431-70	1	2-lug screw-type
(26) 431-62	2	3-lug miniature
(27) 431-10	2	3-lug
(28) 431-11	1	5-lug
(29) 431-45	3	6-lug
SOCKETS-CONNECTORS-PLUGS		
(30) 434-34	2	Tube socket
(31) 434-82	2	Double phono socket
(32) 434-88	2	Pilot lamp socket
(33) 436-5	2	Coaxial connector
(34) 438-4	3	Phono plug

PARTS PICTORIAL



CONTINUED ON FOLD-OUT FROM PAGE 4.

STEP-BY-STEP ASSEMBLY

Before you begin to assemble the kit, read the Kit Builders Guide for complete information on wiring, soldering, and step-by-step assembly procedures.

As you mount a part on the chassis, SWR bridge base, or on the front panel, use the hardware specified in the step and position the part as shown in the Pictorial. The step may call out only the size and type of hardware to use. For example: "Use 6-32 x 1/4" hardware" means to use a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut. Lockwashers will be used under all nuts when you mount parts, unless the step directs otherwise.

The plastic nut starter (#490-5) will help you pick up a nut and start it on the screw threads. Be sure to tighten the hardware with a screwdriver after you mount a part.

SWR BRIDGE SUBASSEMBLY

Refer to Pictorial 1 (fold-out from Page 7) for the following steps.

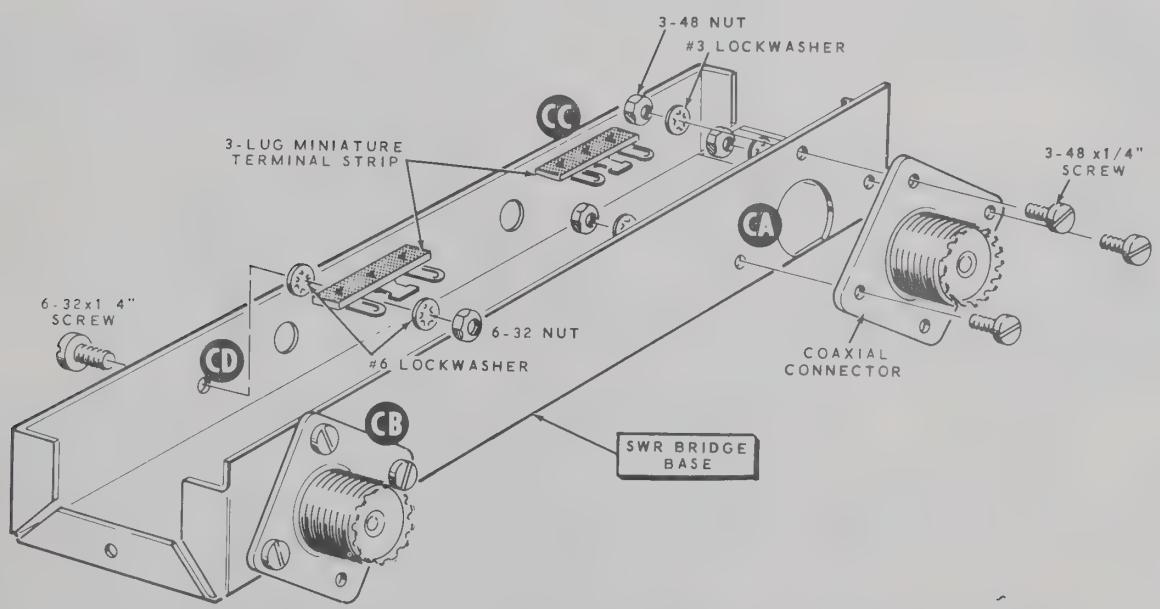
( ) Locate the small hole in the rear of the SWR bridge base that is marked "prethread" on Pictorial 1. Start a #6 x 3/8" sheet metal screw part way into this hole, and then remove the screw. This prethreading will make it easier to install the SWR bridge cover after you have assembled the kit.

( ) Install a coaxial connector at CA on the SWR bridge base as shown in Detail 1A. Use 3-48 x 1/4" hardware.

( ) Similarly, install the other coaxial connector at CB.

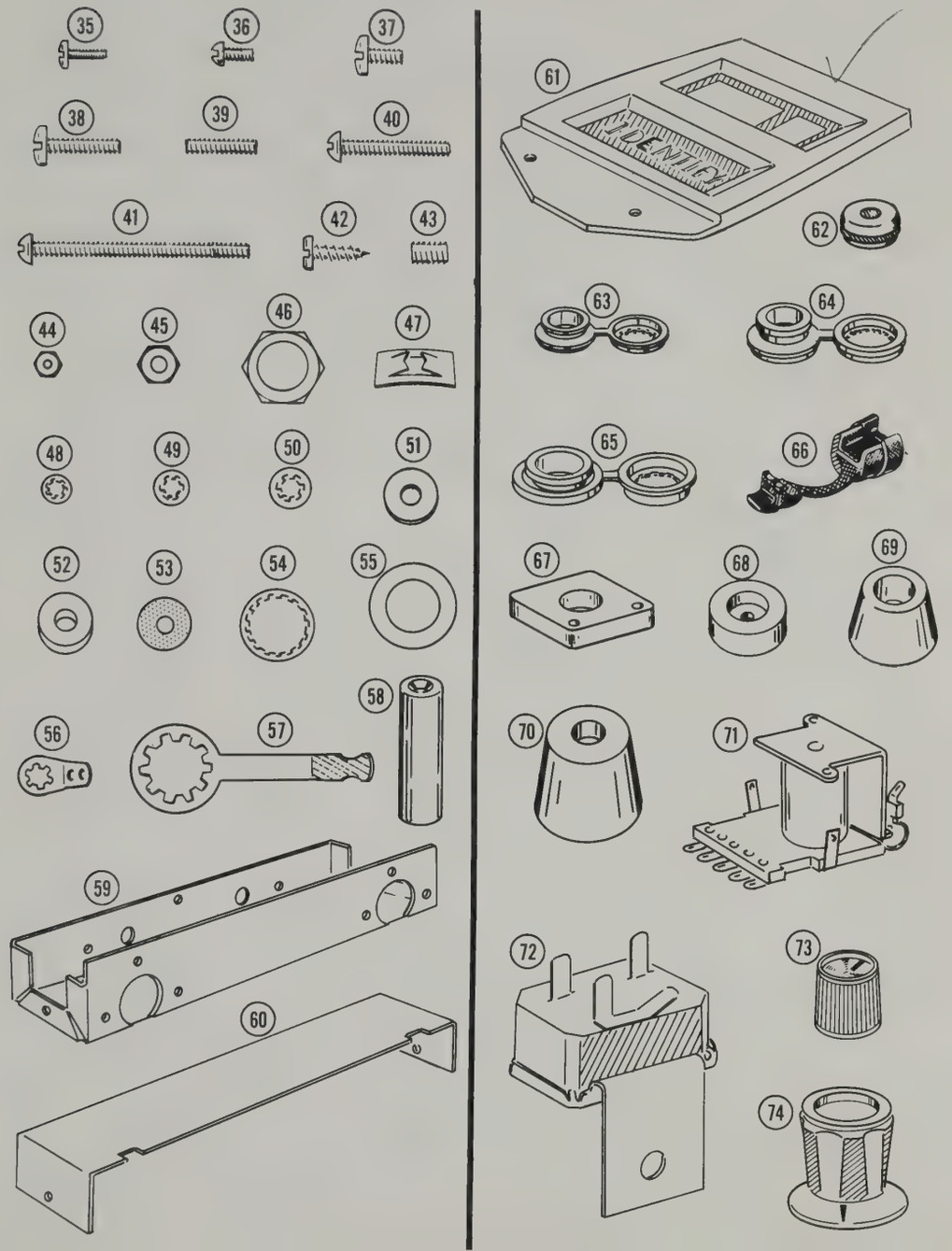
( ) Mount a 3-lug miniature terminal strip at CD on the SWR bridge base. Use a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut. Position the terminal strip as shown in Detail 1A.

( ) Similarly, mount the other 3-lug miniature terminal strip at CC.



Detail 1A

PARTS PICTORIAL (continued)



PART No.	PARTS Per Kit	DESCRIPTION
HARDWARE		
Screws		
(35) 250-49	12	3-48 x 1/4"
(36) 250-2	2	4-40 x 3/16"
(37) 250-56	22	6-32 x 1/4"
(38) 250-162	9	6-32 x 1/2"
(39) 250-143	2	6-32 x 1/2" stud
(40) 250-29	4	6-32 x 3/4"
(41) 250-40	2	6-32 x 1-1/2"
(42) 250-8	3	#6 x 3/8" sheet metal
(43) 250-93	5	8-32 x 1/4" setscrew
Nuts		
(44) 252-1	12	3-48
(45) 252-3	27	6-32
(46) 252-7	7	Control nut
(47) 252-10	4	Speednut
Washers		
(48) 254-7	12	#3 lockwasher
(49) 254-9	2	#4 lockwasher
(50) 254-1	39	#6 lockwasher
(51) 253-60	5	Thin #6 flat washer
(52) 253-27	2	Thick #6 flat washer
(53) 253-1	2	#6 fiber washer
(54) 254-5	4	Control lockwasher
(55) 253-10	7	Control flat washer
Other Hardware		
(56) 259-1	2	#6 solder lug
(57) 259-10	3	Control solder lug
(58) 255-21	2	7/8" tapped spacer
WIRE-CABLE-HARNESS-SLEEVING		
89-1	1	Line cord
344-50	1	Hookup wire
347-9	1	3-wire shielded cable
134-141	1	Harness
346-1	1	Sleeving

PART No.	PARTS Per Kit	DESCRIPTION
SHEET METAL PARTS		
90-337	1	Cabinet shell
200-477-1	1	Chassis
203-458-1	1	Front panel
(59) 206-325	1	SWR bridge base
(60) 206-326	1	SWR bridge cover
PLASTIC AND RUBBER PARTS		
(61) 100-603	1	Escutcheon
(62) 73-4	1	5/16" rubber grommet
(63) 73-46	3	5/16" plastic grommet
(64) 73-43	4	3/8" plastic grommet
(65) 73-44	1	3/4" plastic grommet
(66) 75-24	1	Line cord strain relief
(67) 255-12	3	Plastic spacer
(68) 261-9	4	Rubber foot
(69) 261-25	2	Plastic foot
(70) 255-59	2	Foot spacer
MISCELLANEOUS		
(71) 69-34	1	DPDT relay
(72) 69-42	1	Buzzer
406-49	1	Clock movement
407-114	1	Meter
(73) 462-159	1	Small knob
(74) 462-191	5	Skirted knob
391-48	1	Heathkit nameplate
490-5	1	Nut starter
490-6	1	#8 allen wrench
597-367	1	Registration card
597-308	1	Kit Builders Guide
597-260	1	Parts Order Form
391-34	1	Blue and white identification label
	1	Manual (See front cover for part number.)
		Solder

STEP-BY-STEP ASSEMBLY

Before you begin to assemble the kit, read the Kit Builders Guide for complete information on wiring, soldering, and step-by-step assembly procedures.

As you mount a part on the chassis, SWR bridge base, or on the front panel, use the hardware specified in the step and position the part as shown in the Pictorial. The step may call out only the size and type of hardware to use. For example: "Use 6-32 x 1/4" hardware" means to use a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut. Lockwashers will be used under all nuts when you mount parts, unless the step directs otherwise.

The plastic nut starter (#490-5) will help you pick up a nut and start it on the screw threads. Be sure to tighten the hardware with a screwdriver after you mount a part.

SWR BRIDGE SUBASSEMBLY

Refer to Pictorial 1 (fold-out from Page 7) for the following steps.

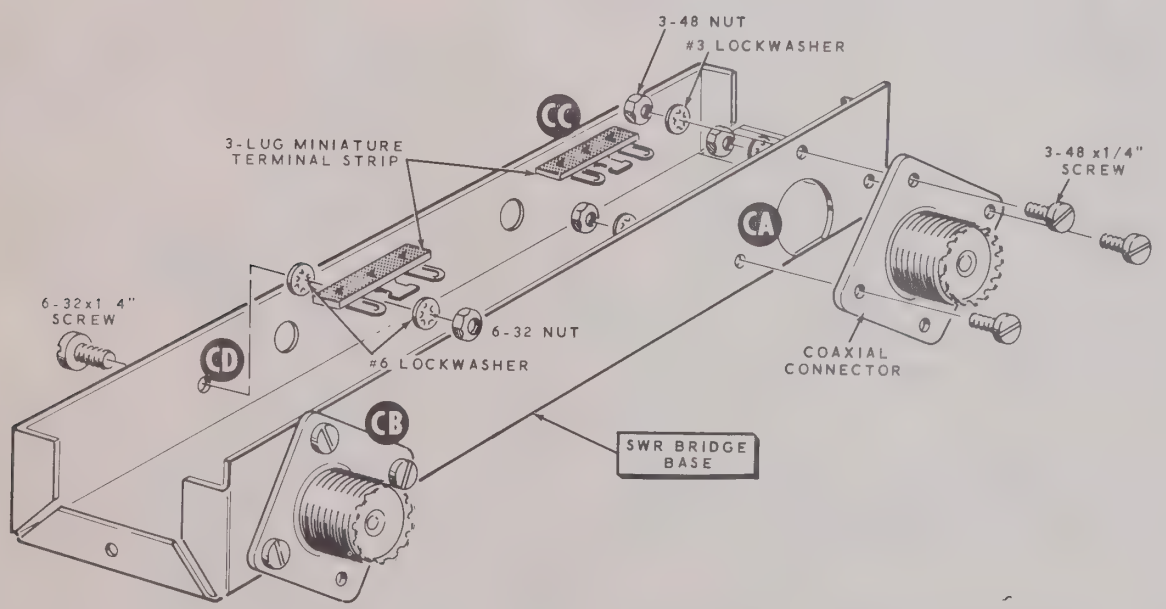
( ) Locate the small hole in the rear of the SWR bridge base that is marked "prethread" on Pictorial 1. Start a #6 x 3/8" sheet metal screw part way into this hole, and then remove the screw. This prethreading will make it easier to install the SWR bridge cover after you have assembled the kit.

( ) Install a coaxial connector at CA on the SWR bridge base as shown in Detail 1A. Use 3-48 x 1/4" hardware.

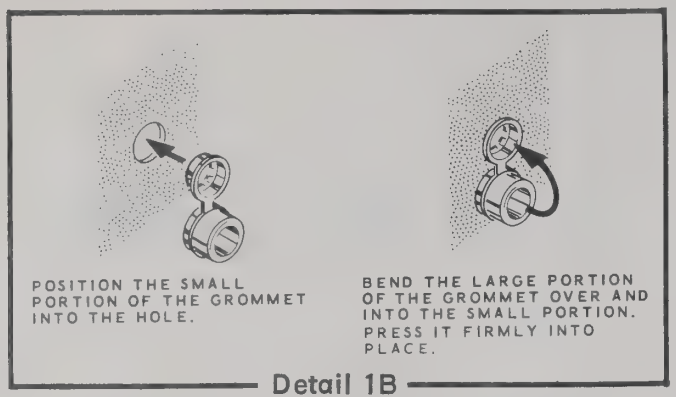
( ) Similarly, install the other coaxial connector at CB.

( ) Mount a 3-lug miniature terminal strip at CD on the SWR bridge base. Use a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut. Position the terminal strip as shown in Detail 1A.

( ) Similarly, mount the other 3-lug miniature terminal strip at CC.



Detail 1A


POSITION THE SMALL PORTION OF THE GROMMET INTO THE HOLE.
BEND THE LARGE PORTION OF THE GROMMET OVER AND INTO THE SMALL PORTION. PRESS IT FIRMLY INTO PLACE.

Detail 1B

(✓) Refer to Detail 1B and install a 5/16" plastic grommet at CE.

(✓) Similarly, install another 5/16" plastic grommet at CF.

(✓) Fit the end holes of the RF driver element over the center terminals of the coaxial connectors as shown in Detail 1C. If the holes do not fit properly, loosen the hardware on the coaxial connectors and move them to obtain a proper fit. Then retighten the hardware and remove the driver element.

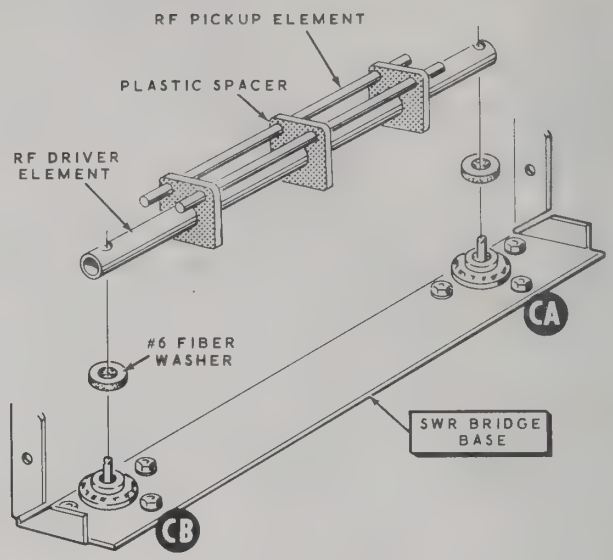
(✓) Place #6 fiber washers over the center terminal of coaxial connectors CA and CB as shown in Detail 1C.

(✓) Slide the three plastic spacers onto the RF driver element. Line up the small holes in the spacers and slide the RF pickup elements through the holes.

(✓) Move all three plastic spacers to the center of the RF elements. Then reinstall the driver element on the center terminals of the coaxial connectors.

(✓) Solder the ends of the driver element to the center terminals of the coaxial connectors. See inset drawing #1 on Pictorial 1.

(✓) Position the plastic spacers and the RF pickup elements as shown by the dimensions in Pictorial 1.



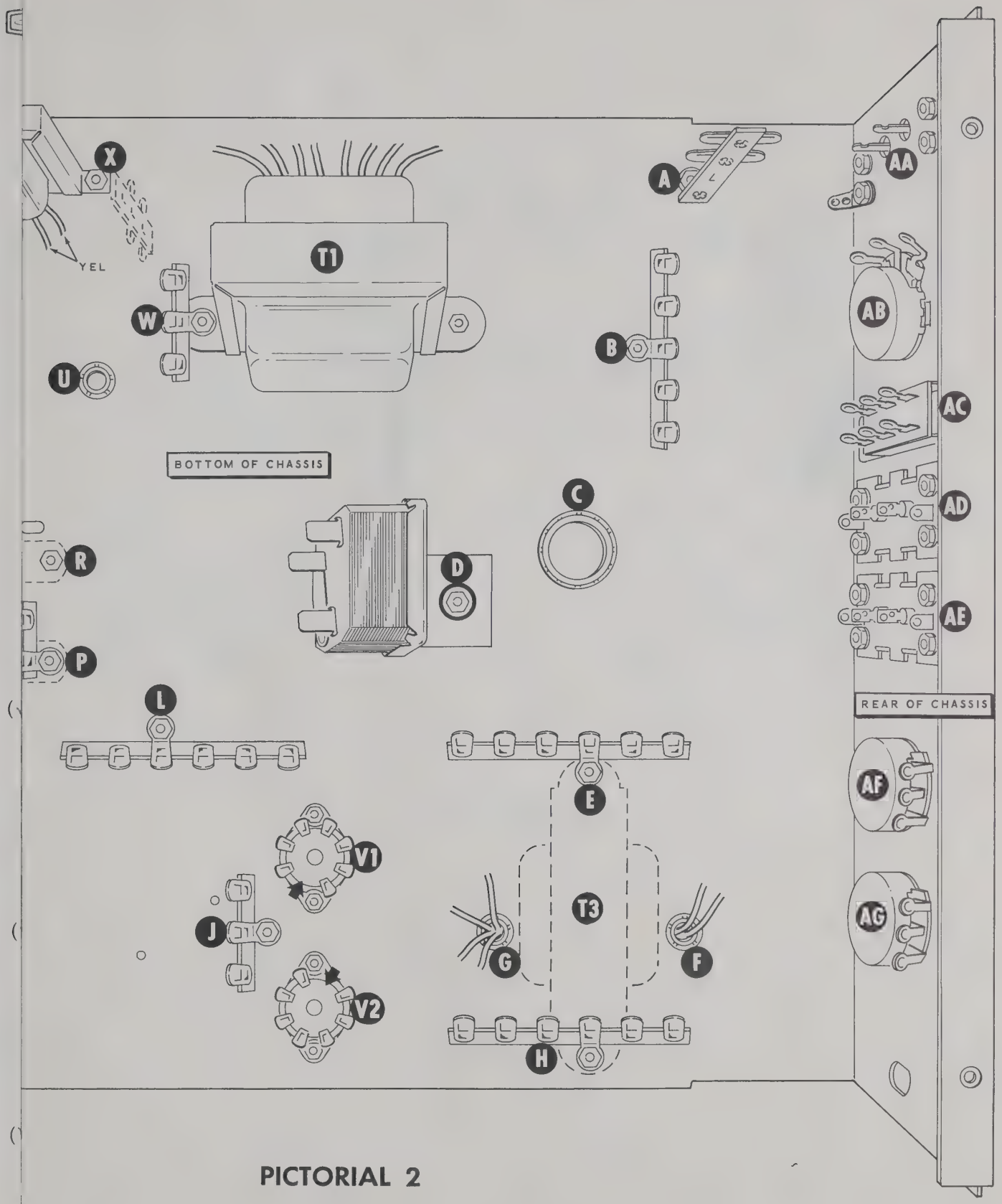
Detail 1C

NOTE: Use 1/2 watt resistors unless the step directs otherwise. Resistors will be called out by resistance value (in Ω, KΩ, or megohms) and the color code. Capacitors will be called by only the capacitance and type.

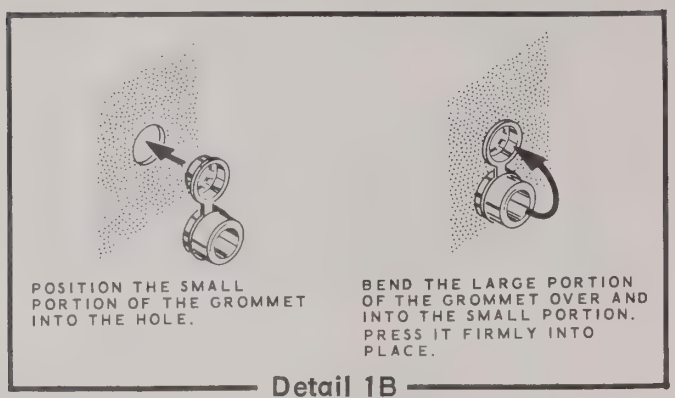
(✓) Cut the leads of a .005 μfd disc capacitor to 3/8". Connect this capacitor from lug 2 (NS) to lug 3 (NS) of terminal strip CC. Position the capacitor as shown in the Pictorial.

(✓) Cut the leads of the other .005 μfd disc capacitor to 3/8". Connect this capacitor from lug 1 (NS) to lug 2 (NS) of terminal strip CD. Position the capacitor as shown.

Refer to the Antenna Line Impedance Chart in Pictorial 1 and select the proper resistors to use for R1 and R2 in the next two steps. If the reflected power and SWR Meter is to be used with a 50-52 Ω line, use the 56 Ω (green-blue-black) resistor for R1, and the 100 Ω (brown-black-brown) resistor for R2. If it is to be used with a 70-75 Ω line, use the 33 Ω (orange-orange-black) resistor for R1, and the 75 Ω (violet-green-black) resistor for R2.


X
YEL
T1
W
U
A
AA
B
AB
AC
AD
AE
BOTTOM OF CHASSIS
C
D
R
P
L
REAR OF CHASSIS
AF
AG
E
V1
J
T3
G
F
V2
H

PICTORIAL 2


POSITION THE SMALL PORTION OF THE GROMMET INTO THE HOLE.
BEND THE LARGE PORTION OF THE GROMMET OVER AND INTO THE SMALL PORTION. PRESS IT FIRMLY INTO PLACE.

Detail 1B

(✓) Refer to Detail 1B and install a 5/16" plastic grommet at CE.

(✓) Similarly, install another 5/16" plastic grommet at CF.

(✓) Fit the end holes of the RF driver element over the center terminals of the coaxial connectors as shown in Detail 1C. If the holes do not fit properly, loosen the hardware on the coaxial connectors and move them to obtain a proper fit. Then retighten the hardware and remove the driver element.

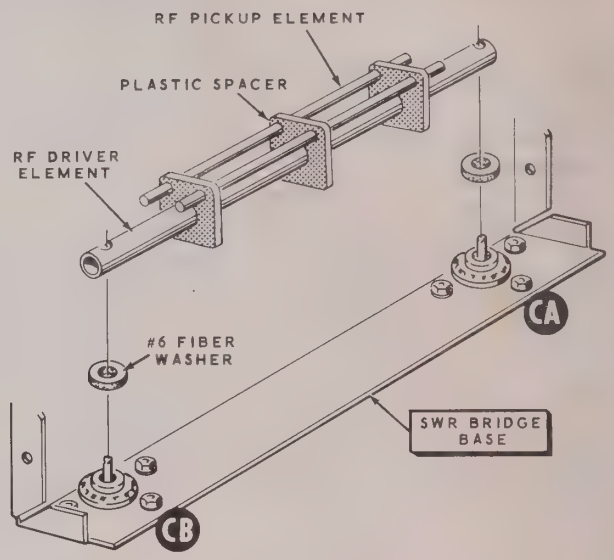
(✓) Place #6 fiber washers over the center terminal of coaxial connectors CA and CB as shown in Detail 1C.

(✓) Slide the three plastic spacers onto the RF driver element. Line up the small holes in the spacers and slide the RF pickup elements through the holes.

(✓) Move all three plastic spacers to the center of the RF elements. Then reinstall the driver element on the center terminals of the coaxial connectors.

(✓) Solder the ends of the driver element to the center terminals of the coaxial connectors. See inset drawing #1 on Pictorial 1.

(✓) Position the plastic spacers and the RF pickup elements as shown by the dimensions in Pictorial 1.



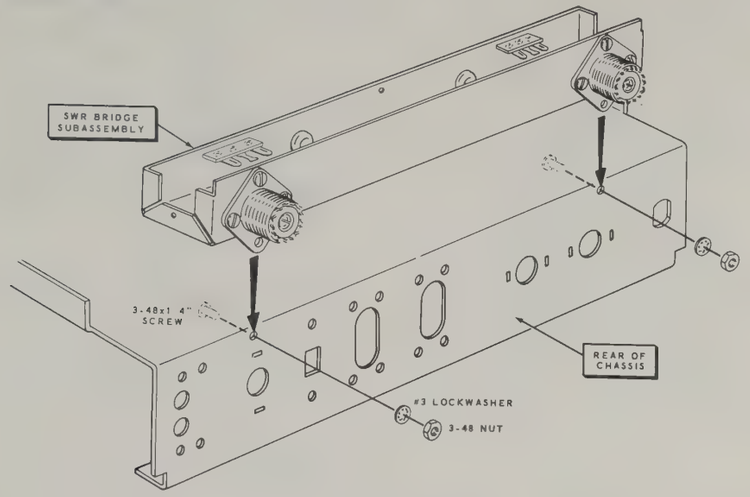
Detail 1C

NOTE: Use 1/2 watt resistors unless the step directs otherwise. Resistors will be called out by resistance value (in Ω, KΩ, or megohms) and the color code. Capacitors will be called by only the capacitance and type.

(✓) Cut the leads of a .005 μfd disc capacitor to 3/8". Connect this capacitor from lug 2 (NS) to lug 3 (NS) of terminal strip CC. Position the capacitor as shown in the Pictorial.

(✓) Cut the leads of the other .005 μfd disc capacitor to 3/8". Connect this capacitor from lug 1 (NS) to lug 2 (NS) of terminal strip CD. Position the capacitor as shown.

Refer to the Antenna Line Impedance Chart in Pictorial 1 and select the proper resistors to use for R1 and R2 in the next two steps. If the reflected power and SWR Meter is to be used with a 50-52 Ω line, use the 56 Ω (green-blue-black) resistor for R1, and the 100 Ω (brown-black-brown) resistor for R2. If it is to be used with a 70-75 Ω line, use the 33 Ω (orange-orange-black) resistor for R1, and the 75 Ω (violet-green-black) resistor for R2.



Detail 1D

(√) Cut both leads of resistor R2 to 1/4" and bend a hook in the end of one lead as shown in inset drawing #2 on Pictorial 1. Connect the hooked lead of the resistor to the end of RF pickup element L2 (S-1) at E. Position the resistor as shown in Pictorial 1 and connect the other lead to lug 2 of terminal strip CC (S-2).

(√) Cut both leads of resistor R1 to 3/8" and bend a hook in the end of one lead. Connect the hooked lead of the resistor to the end of RF pickup element L1 at H (S-1). Position the resistor as shown in Pictorial 1 and connect the other lead to lug 2 of terminal strip CD (S-2).

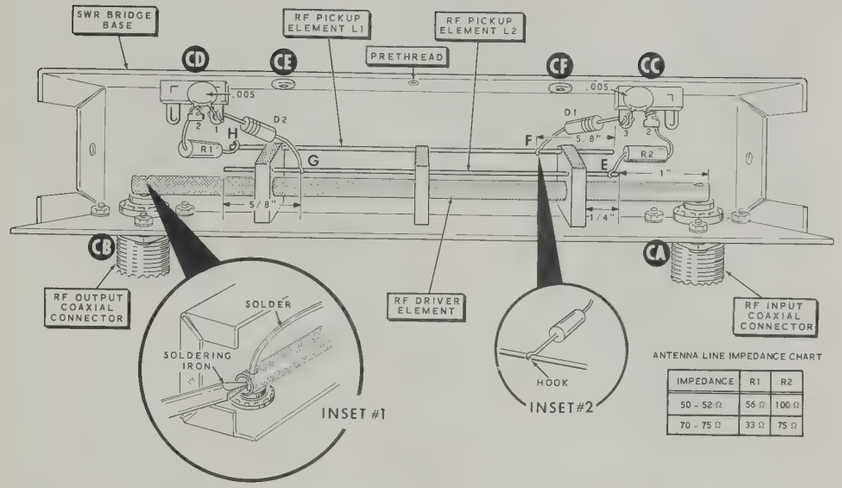
(√) Remeasure the position of the RF pickup elements and be sure their ends are still 1" from the ends of the RF driver element. Bend the leads of resistors R1 and R2, if necessary, to move the RF pickup elements to the correct position.

(√) Cut both leads of a #56-26 germanium diode (brown-white-brown) to 3/8". Bend a hook in the end of the lead from the unbanded end of the diode. Connect this hooked lead to point G, which is exactly 5/8" in from the end of RF pickup element L2 (S-1). Connect the lead from the banded end of the diode to lug 1 of terminal strip CD (NS).

(√) Cut both leads of a #56-26 germanium diode (brown-white-brown) to 1/2". Bend a hook in the end of the lead from the unbanded end of the diode. Connect the hooked lead to point F, which is exactly 5/8" in from the end of RF pickup element L1 (S-1). Connect the lead from the banded end of the diode to lug 3 of terminal strip CD (NS).

(√) Mount the SWR bridge subassembly on the chassis as shown in Detail 1D. Use 3-48 x 1/4" hardware.

This completes the assembly, prewiring, and mounting of the SWR bridge subassembly. Continue with the Chassis Parts Mounting section that follows.



ANTENNA LINE IMPEDANCE CHART

IMPEDANCE	R1	R2
50 - 52 Ω	56 Ω	100 Ω
70 - 75 Ω	33 Ω	75 Ω

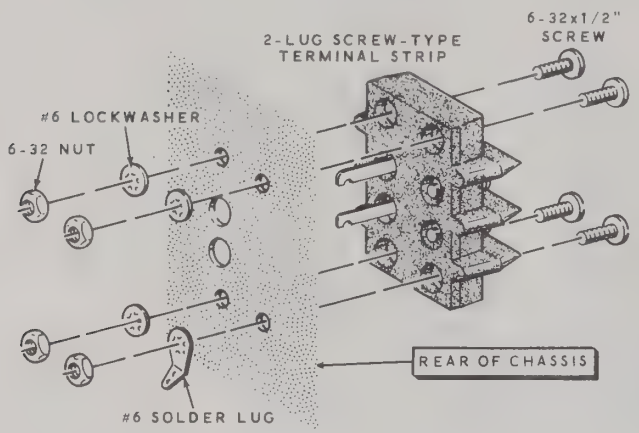
PICTORIAL 1

CHASSIS PARTS MOUNTING

Refer to Pictorial 2 for the following steps.

( ) Position the chassis as shown.

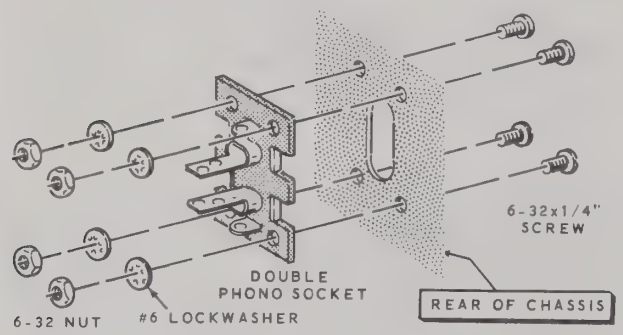
( ) Mount the 2-lug screw-type terminal strip at AA. Use 6-32 x 1/2" hardware and a #6 solder lug as shown in Detail 2A.



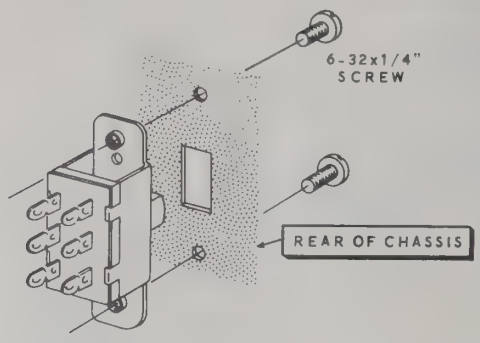
Detail 2A

( ) Mount a double phono socket at AD. Use 6-32 x 1/4" hardware as shown in Detail 2B.

( ) Similarly, mount the other double phono socket at AE.



Detail 2B



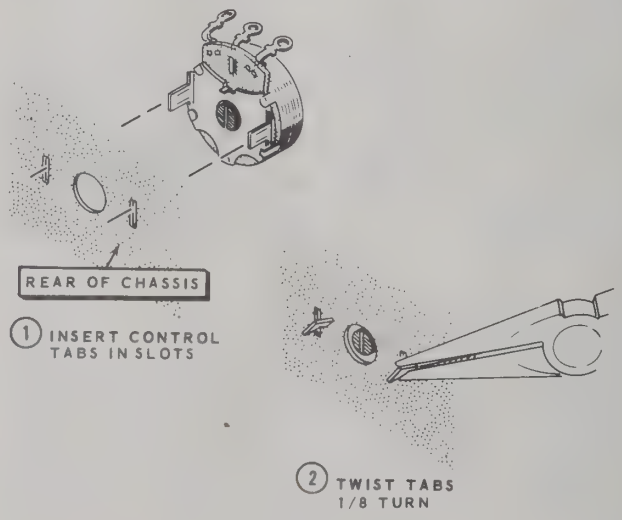
Detail 2C

( ) Refer to Detail 2C and mount the DPDT slide switch (#60-2) at AC. Use two 6-32 x 1/4" screws.

( ) Refer to Detail 2D and mount the 2000 Ω tab-mount control (#10-52) at AB. Position the control lugs as shown and twist the tabs to lock the control in place.

( ) Similarly, mount the 10 KΩ tab-mount control (#10-57) at AF.

( ) In the same manner, mount the 100 KΩ tab-mount control (#10-58) at AG.



Detail 2D

( ) Refer to Detail 2E and install a 7-pin tube socket at V1. Use 3-48 x 1/4" hardware. Position the blank space as shown by the arrow on Pictorial 2.

( ) Similarly, install the other 7-pin tube socket at V2.

When you install terminal strips in the next four steps, use 6-32 x 1/4" hardware and place a lockwasher on each side of the terminal strip mounting foot. See Detail 2F. Position each terminal strip as shown in Pictorial 2.

( ) Install a 2-lug vertical terminal strip at A.

( ) Install a 5-lug terminal strip at B.

( ) Install a 3-lug terminal strip at J.

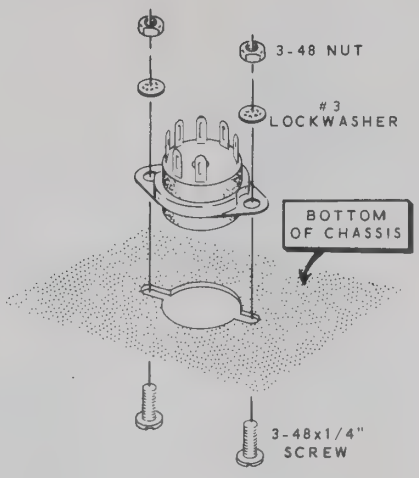
( ) Install a 6-lug terminal strip at L.

Refer to Detail 2G and install plastic grommets at the following locations:

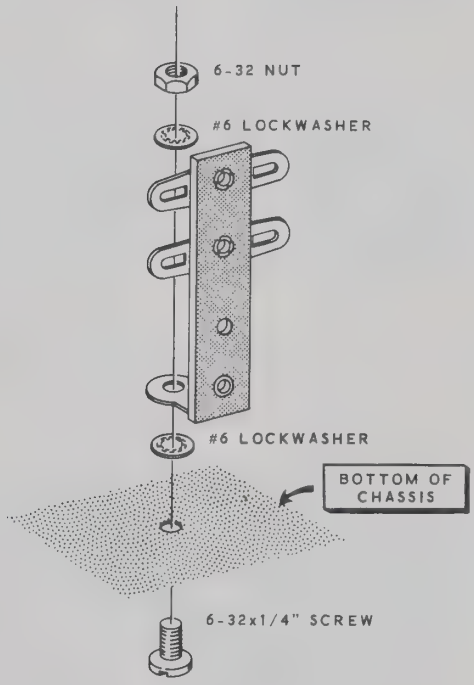
( ) 3/4" at C.

( ) 3/8" at F, G, U, and T1.

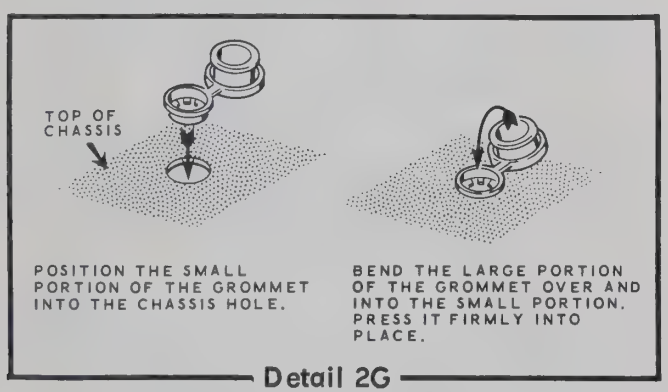
( ) 5/16" at M.



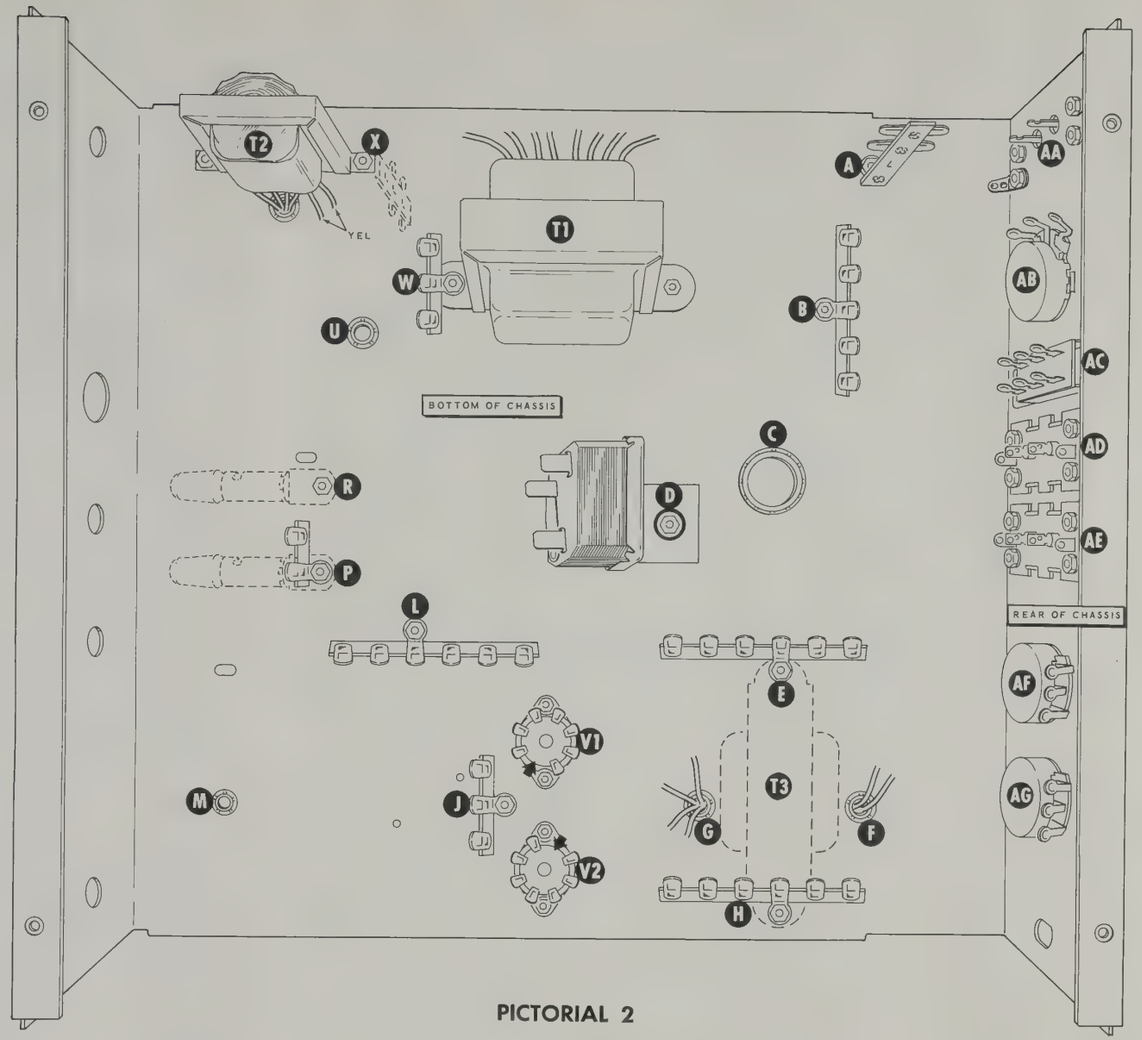
Detail 2E



Detail 2F


TOP OF CHASSIS
POSITION THE SMALL PORTION OF THE GROMMET INTO THE CHASSIS HOLE.
BEND THE LARGE PORTION OF THE GROMMET OVER AND INTO THE SMALL PORTION. PRESS IT FIRMLY INTO PLACE.

Detail 2G



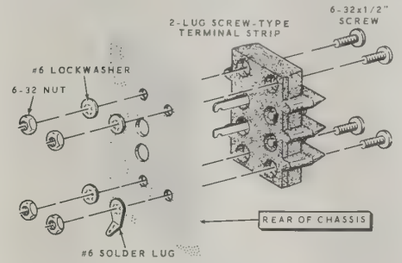
PICTORIAL 2

CHASSIS PARTS MOUNTING

Refer to Pictorial 2 for the following steps.

(✓) Position the chassis as shown.

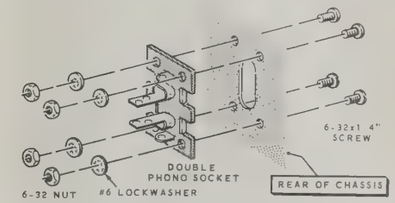
(✓) Mount the 2-lug screw-type terminal strip at AA. Use 6-32 x 1/2" hardware and a #6 solder lug as shown in Detail 2A.



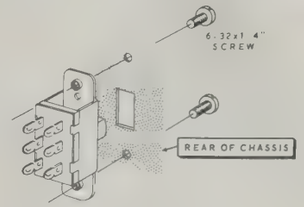
Detail 2A

(✓) Mount a double phono socket at AD. Use 6-32 x 1/4" hardware as shown in Detail 2B.

(✓) Similarly, mount the other double phono socket at AE.



Detail 2B



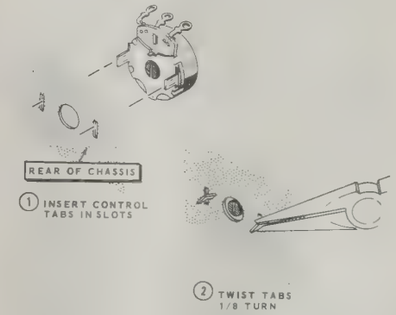
Detail 2C

(✓) Refer to Detail 2C and mount the DPDT slide switch (#60-2) at AC. Use two 6-32 x 1/4" screws.

(✓) Refer to Detail 2D and mount the 2000 Ω tab-mount control (#10-52) at AB. Position the control lugs as shown and twist the tabs to lock the control in place.

(✓) Similarly, mount the 10 KΩ tab-mount control (#10-57) at AF.

(✓) In the same manner, mount the 100 KΩ tab-mount control (#10-58) at AG.



Detail 2D

(✓) Refer to Detail 2E and install a 7-pin tube socket at V1. Use 3-48 x 1/4" hardware. Position the blank space as shown by the arrow on Pictorial 2.

(✓) Similarly, install the other 7-pin tube socket at V2.

When you install terminal strips in the next four steps, use 6-32 x 1/4" hardware and place a lockwasher on each side of the terminal strip mounting foot. See Detail 2F. Position each terminal strip as shown in Pictorial 2.

(✓) Install a 2-lug vertical terminal strip at A.

(✓) Install a 5-lug terminal strip at B.

(✓) Install a 3-lug terminal strip at J.

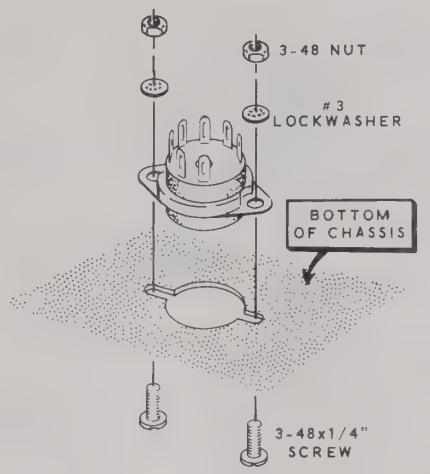
( ) Install a 6-lug terminal strip at L.

Refer to Detail 2G and install plastic grommets at the following locations:

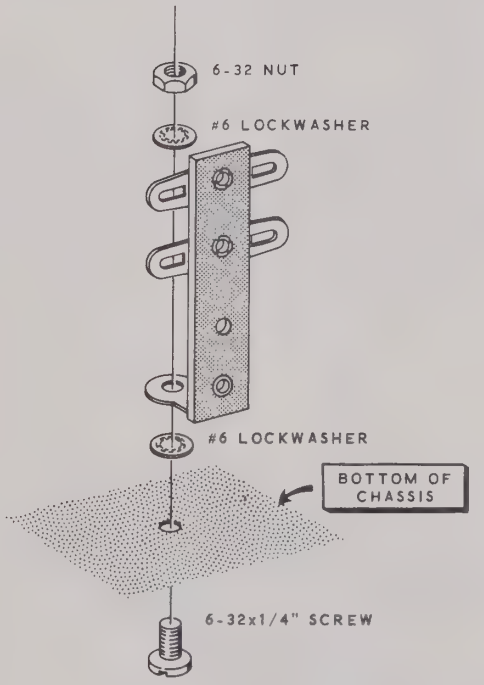
(✓) 3/4" at C.

(✓) 3/8" at F, G, U, and T1.

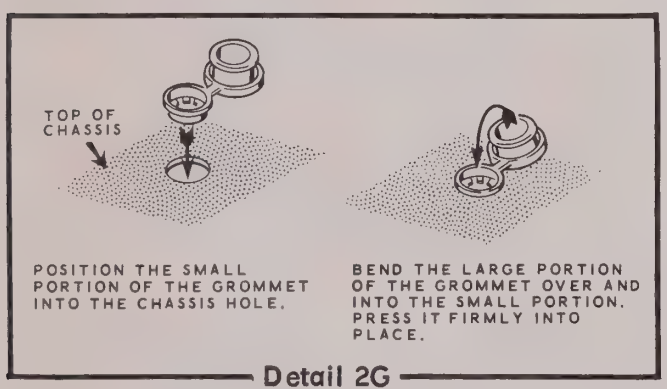
(✓) 5/16" at M.



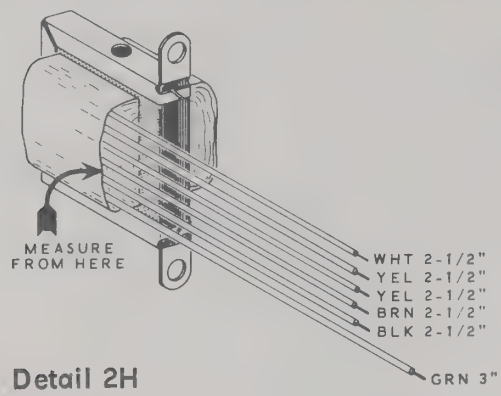
Detail 2E



Detail 2F


TOP OF CHASSIS
POSITION THE SMALL PORTION OF THE GROMMET INTO THE CHASSIS HOLE.
BEND THE LARGE PORTION OF THE GROMMET OVER AND INTO THE SMALL PORTION. PRESS IT FIRMLY INTO PLACE.

Detail 2G

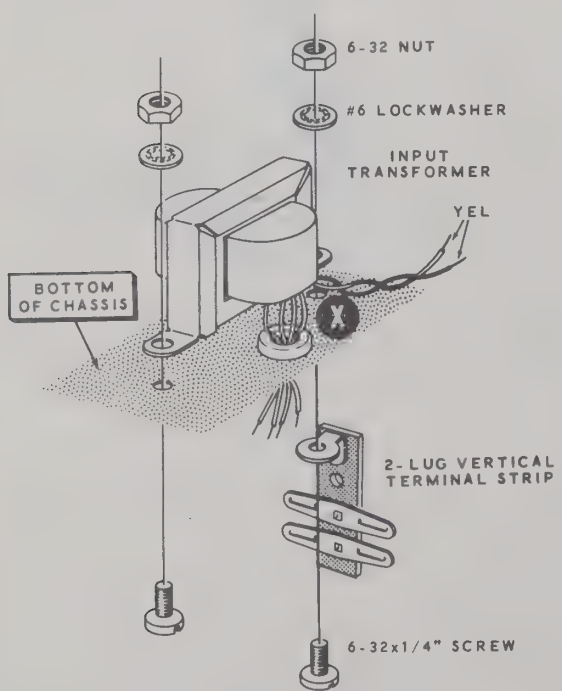


Detail 2H

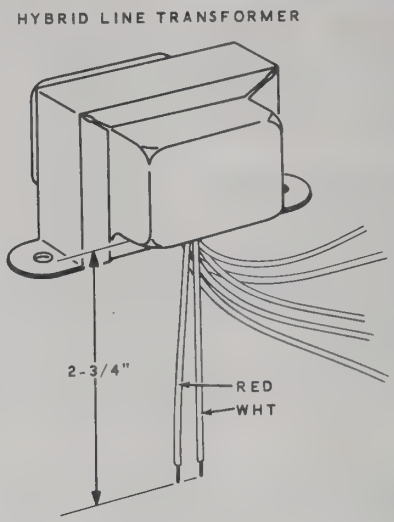
(✓) Cut the leads of input transformer T2 (#51-129) to the lengths shown in Detail 2H; then strip 1/4" of insulation from the end of each lead. If necessary, apply a thin film of solder to the wire ends to hold the strands together.

Refer to Detail 2J and Pictorial 2 as you mount the input transformer and 2-lug vertical terminal strip in the next step.

(✓) Pass all of the transformer leads except the two yellow leads through the grommet at T2. Then mount the transformer on the bottom of the chassis and the 2-lug vertical terminal strip on the top of the chassis at X. Use 6-32 x 1/4" hardware and position the terminal strip as shown.



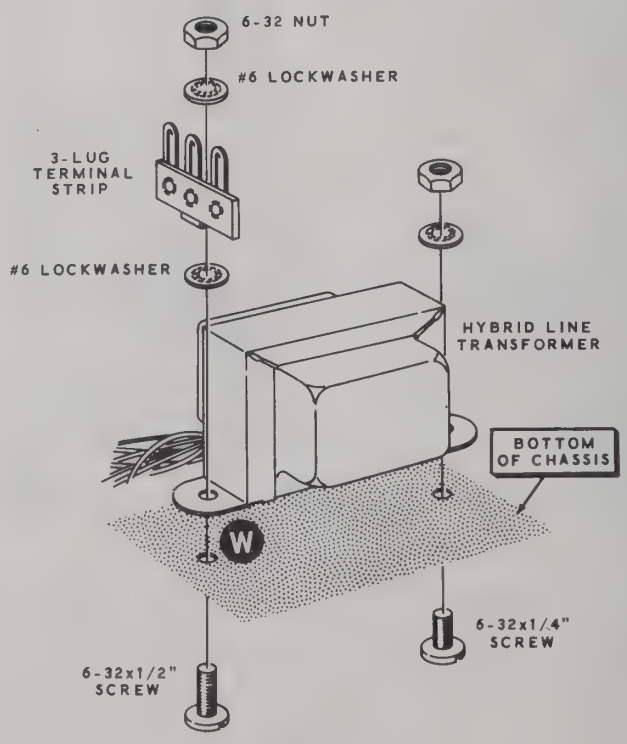
Detail 2J



Detail 2K

(✓) Cut the red lead and the white lead of hybrid line transformer T1 (#51-130) to a length of 2-3/4", as shown in Detail 2K. Then strip 1/4" of insulation from the end of each of these leads and apply a thin film of solder to hold the wire strands together.

(✓) Mount the line transformer at T1 and the 3-lug terminal strip at W as shown in Detail 2L. Use a 6-32 x 1/2" screw, two #6 lockwashers, and a 6-32 nut at W. Use 6-32 x 1/4" hardware at the other end of the transformer.

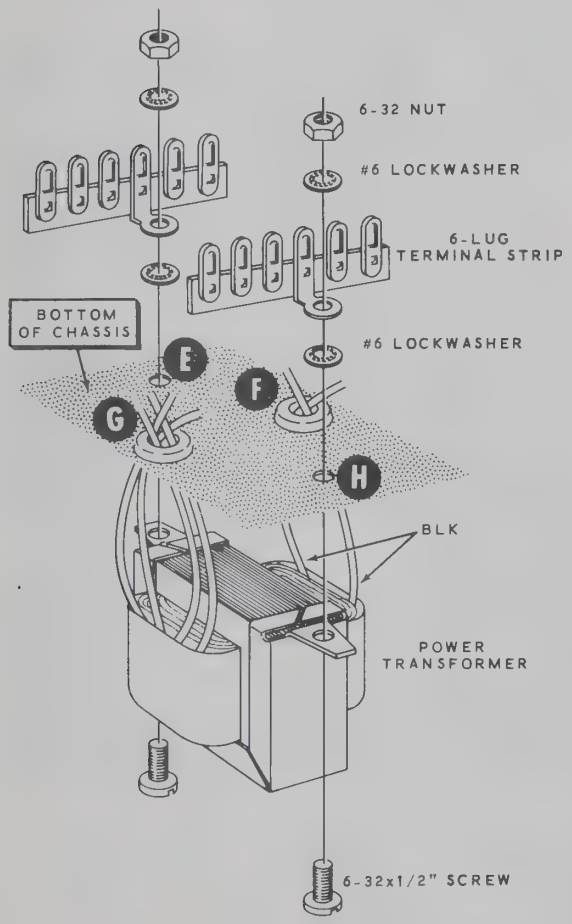


Detail 2L

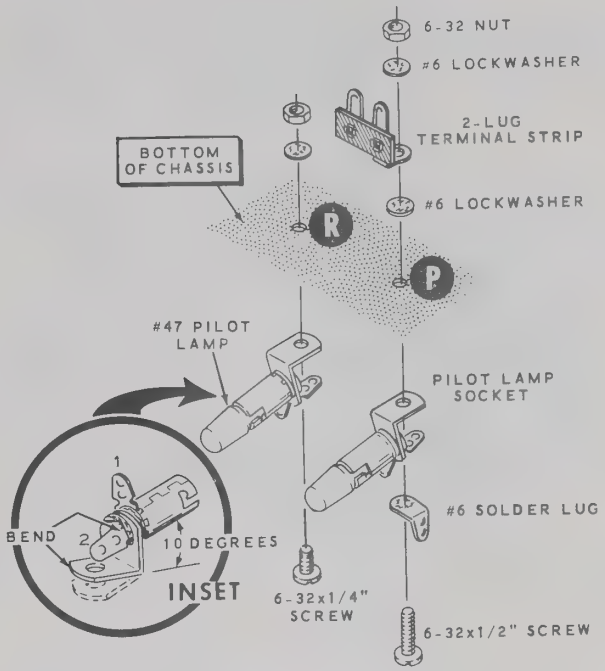
( ) Cut all six leads of power transformer T3 (#54-92) to a length of 3", as measured from the bottom of the transformer windings. Then remove 1/4" of insulation from the end of each lead.

NOTE: When you mount the power transformer and terminal strips in the next step, pass the two black transformer leads through grommet F and pass the other four leads through grommet G. Be sure to place #6 lockwashers under and above the mounting foot of each terminal strip.

( ) Mount the power transformer on top of the chassis at T3 with the 6-lug terminal strips on the bottom of the chassis at E and H, as shown in Detail 2M. Use 6-32 x 1/2" hardware. Position the terminal strips as shown in Pictorial 2.



Detail 2M



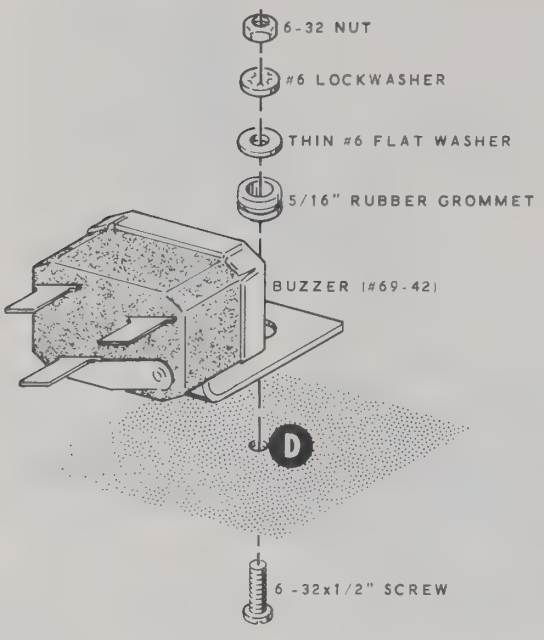
Detail 2N

( ) Refer to the inset drawing on Detail 2N and bend lug 2 of each pilot lamp socket as shown. Then bend the mounting foot of each pilot lamp socket approximately 10 degrees upward as shown.

( ) Install a #47 pilot lamp in each of the two pilot lamp sockets.

( ) Refer to Detail 2N and mount a pilot lamp socket on the top of the chassis, and a 2-lug terminal strip on the bottom of the chassis, at P. Use a 6-32 x 1/2" screw, a #6 solder lug, two #6 lockwashers, and a 6-32 nut as shown.

( ) Mount the other pilot lamp socket on the top of the chassis at R. Use 6-32 x 1/4" hardware as shown in Detail 2N.



Detail 2P

(✓) Refer to Detail 2P and insert a 5/16" rubber grommet in the mounting hole of the buzzer (#69-42). Then mount the buzzer at D. Use a 6-32 x 1/2" screw, a thin #6 flat washer, a #6 lockwasher, and a 6-32 nut.

CHASSIS PREWIRING

NOTE: Be sure you have read the Kit Builders Guide for instructions on wiring and soldering. Neatness and correct placement of wires is also important to the proper operation of your kit. The chassis Photographs (fold-out from Page 36) show the parts positioning and lead placement in a typically wired kit.

Read each step completely before you perform the step as directed. The leads of each component should be cut just long enough to allow them to make good connections with the component positioned as shown in the Pictorial. Trim excess lead lengths after a part is connected.

Refer to Pictorial 3 (fold-out from Page 15) for the following steps.

(✓) Twist together the blue-white and black-white leads from transformer T1 and position the leads as shown in the Pictorial. Connect the blue-white lead to lug 3 (NS) and the black-white lead to lug 2 (S-1) of control AB.

(✓) Connect a 2200 Ω (red-red-red) resistor from lug 1 (S-1) to lug 3 (S-2) of control AB.

(✓) Connect a .002 μfd disc capacitor from the solder lug (NS) to lug 2 of terminal strip AA (NS).

(✓) Connect a .002 μfd disc capacitor from the solder lug (NS) to lug 1 of terminal strip AA (NS).

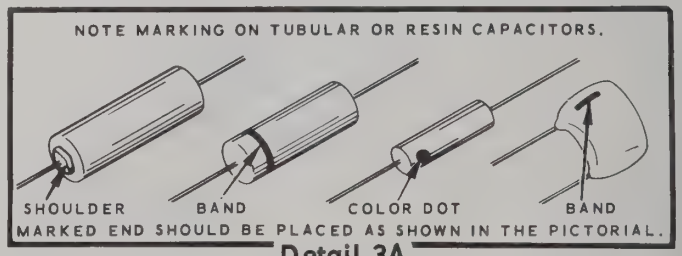
(✓) Connect a .002 μfd disc capacitor from the solder lug at AA (NS) to lug 2 of terminal strip A (S-1).

(✓) Connect a .002 μfd disc capacitor from the solder lug at AA (S-4) to lug 1 of terminal strip A (S-1).

(✓) Connect a 47 μH choke (#45-2) from lug 2 of terminal strip AA (S-2) to lug 4 of terminal strip A (NS).

(✓) Connect a 47 μH choke (#45-2) from lug 1 of terminal strip AA (S-2) to lug 3 of terminal strip A (NS).

NOTE: One end of each resin and tubular capacitor in this kit is marked with a color band, usually a black or white line (see Detail 3A). Be sure to connect the lead from this marked end as directed in the step.



Detail 3A

(✓) Place a 2" length of sleeving on the lead from the marked end of a 2 μfd tubular capacitor, and connect this lead to lug 1 of terminal strip B (NS). Connect the other lead to lug 4 of terminal strip A (S-2). Position the capacitor as shown.

(✓) Connect a 3600 Ω (orange-blue-red) resistor from lug 4 of terminal strip B (NS) to lug 3 of switch AC (S-1).

(✓) Connect the lead from the banded end of a germanium diode (#56-26) to lug 2 (NS) and the other lead to lug 5 (NS) of terminal strip B. Position the diode as shown.

(✓) Connect a 1000 Ω (brown-black-red) resistor from lug 2 of switch AC (S-1) to lug 5 of terminal strip B (S-2).

(✓) Strip the insulation from a 1" piece of hookup wire. Connect this bare wire from lug 4 of switch AC (NS) to lug 1 of double phono socket AD (NS).

(✓) Connect a 15 KΩ (brown-green-orange) resistor from lug 1 of double phono socket AE (S-1) to lug 3 of control AF (S-1).

(✓) Connect either black lead coming from grommet F to lug 5 (NS) and the other black lead to lug 3 (NS) of terminal strip E.

Connect the leads from grommet G as directed in the next four steps.

(✓) Either yellow to lug 4 of tube socket V1 (NS).

(✓) Other yellow to lug 4 of terminal strip E (NS).

(✓) Either red to lug 6 of tube socket V1 (NS).

(✓) Other red to lug 3 of terminal strip H (NS).

NOTE: When a wire passes through a terminal or lug and goes to another point, it will count as two wires in the solder instruction, one entering and one leaving the terminal.

(✓) Strip the insulation from a 1" piece of hookup wire. Connect this bare wire from lug 3 of control AG (S-1) through lug 1 (S-2) to lug 2 (S-1) of control AF.

NOTE: When wiring this kit, you may find it easier to prepare the lengths of wire ahead of time, as in the next step. To prepare a wire, cut it to the indicated length and strip 1/4" of insulation from each end. The wires are listed in the order in which they will be used.

(✓) Prepare the following lengths of hookup wire:

6"	2-1/2"
7"	2-1/4"
3-1/2"	

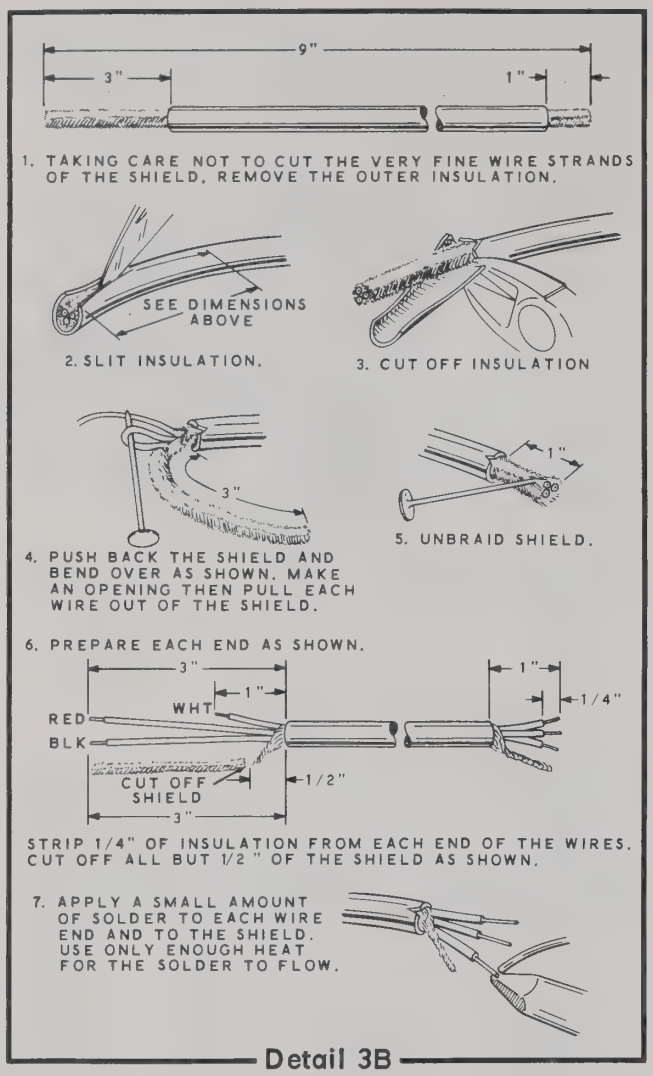
(✓) Connect a 6" wire from lug 1 of control AG (S-1) to lug 2 of terminal strip H (NS).

(✓) Connect a 7" wire from lug 2 of control AG (S-1) to lug 6 of terminal strip L (NS).

(✓) Connect a 3-1/2" wire from lug 2 of terminal strip P (NS) to lug 1 of buzzer D (S-1).

(✓) Connect a 2-1/2" wire from lug 1 of terminal strip E (NS) to lug 2 of tube socket V1 (NS).

(✓) Connect a 2-1/4" wire from lug 2 of terminal strip E (NS) to lug 6 of tube socket V1 (NS).


9"
3"
1"
1. TAKING CARE NOT TO CUT THE VERY FINE WIRE STRANDS OF THE SHIELD, REMOVE THE OUTER INSULATION.
SEE DIMENSIONS ABOVE
2. SLIT INSULATION.
3. CUT OFF INSULATION
3"
4. PUSH BACK THE SHIELD AND BEND OVER AS SHOWN. MAKE AN OPENING THEN PULL EACH WIRE OUT OF THE SHIELD.
1"
5. UNBRAID SHIELD.
6. PREPARE EACH END AS SHOWN.
3"
1"
WHT
RED
BLK
CUT OFF SHIELD
1/2"
3"
1"
1/4"
STRIP 1/4" OF INSULATION FROM EACH END OF THE WIRES. CUT OFF ALL BUT 1/2 " OF THE SHIELD AS SHOWN.
7. APPLY A SMALL AMOUNT OF SOLDER TO EACH WIRE END AND TO THE SHIELD. USE ONLY ENOUGH HEAT FOR THE SOLDER TO FLOW.

Detail 3B

( ) Refer to Detail 3B and prepare a 9" length of 3-wire shielded cable. Be careful not to pull the wires from the jacket while you strip the insulation from the wires.

(✓) At the end of the 3-wire shielded cable with the long red and black leads, connect the shield to lug 2 (S-2) and the white lead to lug 1 (NS) of terminal strip P. The red and black leads will be connected later.

At the other end of the shielded cable, connect the leads to terminal strip E as follows:

(✓) Red to lug 3 (S-2).

(✓) Shield to lug 4 (S-2).

(✓) White to lug 5 (NS).

(✓) Black to lug 6 (NS).

(✓) Cut both leads of a 180 KΩ (brown-gray-yellow) resistor to 1-1/4" and place a 1" length of sleeving on each lead. Connect this resistor from lug 2 of terminal strip H (S-2) to lug 5 of tube socket V2 (NS). Position the resistor as shown in Pictorial 3.

(✓) Connect a 22 megohm (red-red-blue) resistor from lug 5 of tube socket V2 (S-2) to lug 3 of terminal strip J (NS).

(✓) Connect a 22 megohm (red-red-blue) resistor from lug 3 (S-2) to lug 1 (NS) of terminal strip J.

( ) Connect the lead from the marked end of a .2 μfd resin capacitor to lug 3 (S-1) and the other lead to lug 1 (NS) of terminal strip L.

( ) Place a 3/4" length of sleeving on the lead from the marked end of a .2 μfd resin capacitor. Connect this lead to lug 5 (NS) and the other lead to lug 2 (NS) of terminal strip L. Position the capacitor as shown.

( ) Connect a 100 megohm (brown-black-violet) resistor from lug 1 of terminal strip J (S-2) to lug 4 of terminal strip L (NS).

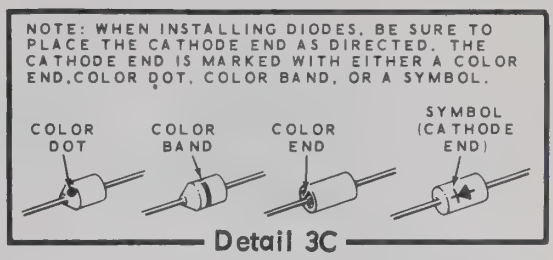
( ) Connect a 220 KΩ (red-red-yellow) resistor from lug 5 (NS) to lug 6 (S-2) of terminal strip L.

( ) Remove the insulation from a 2-1/4" length of hookup wire. Connect this wire from lug 7 of tube socket V2 (NS), through lug 2 of terminal strip J (S-2) through lug 7 of tube socket V1 (NS), to lug 3 of tube socket V1 (S-1).

( ) Connect a 680 Ω (blue-gray-brown) resistor from lug 2 (S-2) to lug 7 (S-3) of tube socket V1.

( ) Connect a 220 KΩ (red-red-yellow) resistor from lug 1 (S-2) to lug 2 (NS) of terminal strip E.

( ) Place a 1" length of sleeving on each lead of a #56-26 germanium diode (brown-white-brown). Connect the lead from the banded end of the diode to lug 1 of tube socket V1 (NS). Then connect the other diode lead to lug 2 of terminal strip L (NS).


NOTE: WHEN INSTALLING DIODES, BE SURE TO PLACE THE CATHODE END AS DIRECTED. THE CATHODE END IS MARKED WITH EITHER A COLOR END, COLOR DOT, COLOR BAND, OR A SYMBOL.
COLOR DOT
COLOR BAND
COLOR END
SYMBOL (CATHODE END)
Detail 3C

Refer to Detail 3C to identify the cathode end of the silicon diodes (#57-27) used in the next two steps.

( ) Connect the lead from the cathode end of a silicon diode to lug 1 (NS) and the other lead to lug 3 (NS) of terminal strip H.

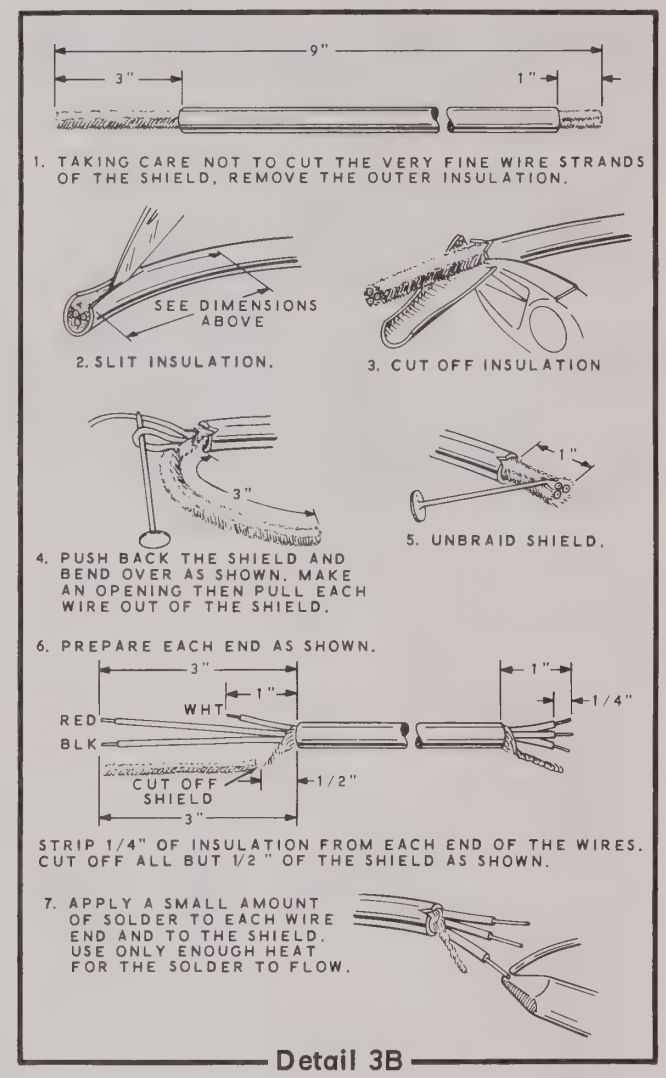
( ) Connect the lead from the cathode end of a silicon diode to lug 3 (S-3) and the other lead to lug 4 (NS) of terminal strip H.

( ) Twist together the two yellow leads from transformer T2. Connect either yellow lead to lug 1 (NS) and the other to lug 3 (NS) of terminal strip W.

( ) Twist together the red lead and white lead from transformer T1. Connect the white lead to lug 1 (S-2) and the red lead to lug 3 (S-2) of terminal strip W.

( ) Twist together the blue lead and black lead from transformer T1. Pass these two leads through the grommet at T2 to the top of the chassis; they will be connected later.

Set the chassis aside until it is called for later.


9"
3"
1"
1. TAKING CARE NOT TO CUT THE VERY FINE WIRE STRANDS OF THE SHIELD, REMOVE THE OUTER INSULATION.
SEE DIMENSIONS ABOVE
2. SLIT INSULATION.
3. CUT OFF INSULATION
3"
4. PUSH BACK THE SHIELD AND BEND OVER AS SHOWN. MAKE AN OPENING THEN PULL EACH WIRE OUT OF THE SHIELD.
1"
5. UNBRAID SHIELD.
6. PREPARE EACH END AS SHOWN.
3"
1"
WHT
RED
BLK
CUT OFF SHIELD
1/2"
3"
1"
1/4"
STRIP 1/4" OF INSULATION FROM EACH END OF THE WIRES. CUT OFF ALL BUT 1/2 " OF THE SHIELD AS SHOWN.
7. APPLY A SMALL AMOUNT OF SOLDER TO EACH WIRE END AND TO THE SHIELD. USE ONLY ENOUGH HEAT FOR THE SOLDER TO FLOW.

Detail 3B

( ) Refer to Detail 3B and prepare a 9" length of 3-wire shielded cable. Be careful not to pull the wires from the jacket while you strip the insulation from the wires.

(✓) At the end of the 3-wire shielded cable with the long red and black leads, connect the shield to lug 2 (S-2) and the white lead to lug 1 (NS) of terminal strip P. The red and black leads will be connected later.

At the other end of the shielded cable, connect the leads to terminal strip E as follows:

(✓) Red to lug 3 (S-2).

(✓) Shield to lug 4 (S-2).

(✓) White to lug 5 (NS).

(✓) Black to lug 6 (NS).

(✓) Cut both leads of a 180 KΩ (brown-gray-yellow) resistor to 1-1/4" and place a 1" length of sleeving on each lead. Connect this resistor from lug 2 of terminal strip H (S-2) to lug 5 of tube socket V2 (NS). Position the resistor as shown in Pictorial 3.

(✓) Connect a 22 megohm (red-red-blue) resistor from lug 5 of tube socket V2 (S-2) to lug 3 of terminal strip J (NS).

(✓) Connect a 22 megohm (red-red-blue) resistor from lug 3 (S-2) to lug 1 (NS) of terminal strip J.

( ) Connect the lead from the marked end of a .2 μfd resin capacitor to lug 3 (S-1) and the other lead to lug 1 (NS) of terminal strip L.

( ) Place a 3/4" length of sleeving on the lead from the marked end of a .2 μfd resin capacitor. Connect this lead to lug 5 (NS) and the other lead to lug 2 (NS) of terminal strip L. Position the capacitor as shown.

( ) Connect a 100 megohm (brown-black-violet) resistor from lug 1 of terminal strip J (S-2) to lug 4 of terminal strip L (NS).

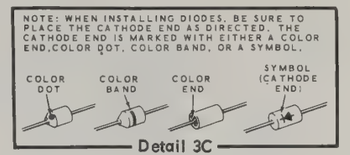
( ) Connect a 220 KΩ (red-red-yellow) resistor from lug 5 (NS) to lug 6 (S-2) of terminal strip L.

( ) Remove the insulation from a 2-1/4" length of hookup wire. Connect this wire from lug 7 of tube socket V2 (NS), through lug 2 of terminal strip J (S-2) through lug 7 of tube socket V1 (NS), to lug 3 of tube socket V1 (S-1).

( ) Connect a 680 Ω (blue-gray-brown) resistor from lug 2 (S-2) to lug 7 (S-3) of tube socket V1.

( ) Connect a 220 KΩ (red-red-yellow) resistor from lug 1 (S-2) to lug 2 (NS) of terminal strip E.

( ) Place a 1" length of sleeving on each lead of a #56-26 germanium diode (brown-white-brown). Connect the lead from the banded end of the diode to lug 1 of tube socket V1 (NS). Then connect the other diode lead to lug 2 of terminal strip L (NS).


NOTE: WHEN INSTALLING DIODES, BE SURE TO PLACE THE CATHODE END AS DIRECTED. THE CATHODE END IS MARKED WITH EITHER A COLOR END, COLOR DOT, COLOR BAND, OR A SYMBOL.
COLOR DOT
COLOR BAND
COLOR END
SYMBOL (CATHODE END)
Detail 3C

Refer to Detail 3C to identify the cathode end of the silicon diodes (#57-27) used in the next two steps.

( ) Connect the lead from the cathode end of a silicon diode to lug 1 (NS) and the other lead to lug 3 (NS) of terminal strip H.

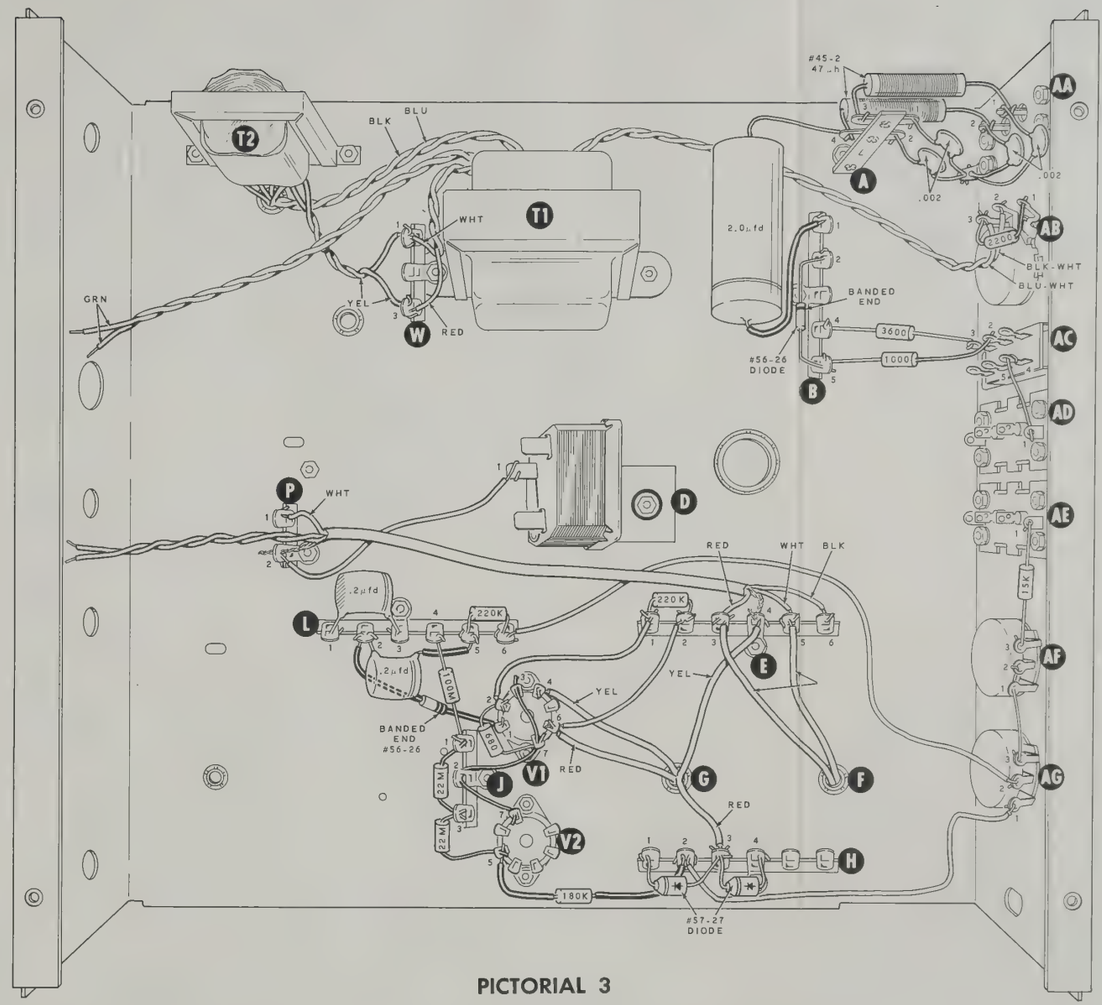
( ) Connect the lead from the cathode end of a silicon diode to lug 3 (S-3) and the other lead to lug 4 (NS) of terminal strip H.

( ) Twist together the two yellow leads from transformer T2. Connect either yellow lead to lug 1 (NS) and the other to lug 3 (NS) of terminal strip W.

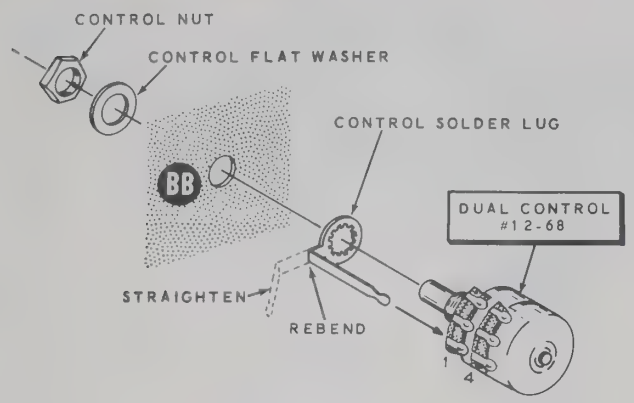
( ) Twist together the red lead and white lead from transformer T1. Connect the white lead to lug 1 (S-2) and the red lead to lug 3 (S-2) of terminal strip W.

( ) Twist together the blue lead and black lead from transformer T1. Pass these two leads through the grommet at T2 to the top of the chassis; they will be connected later.

Set the chassis aside until it is called for later.



PICTORIAL 3

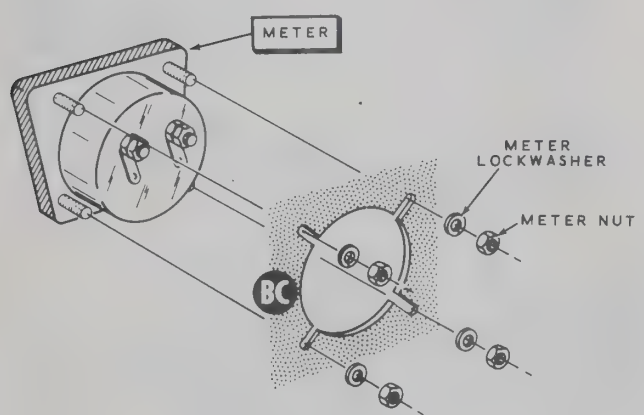


Detail 4C

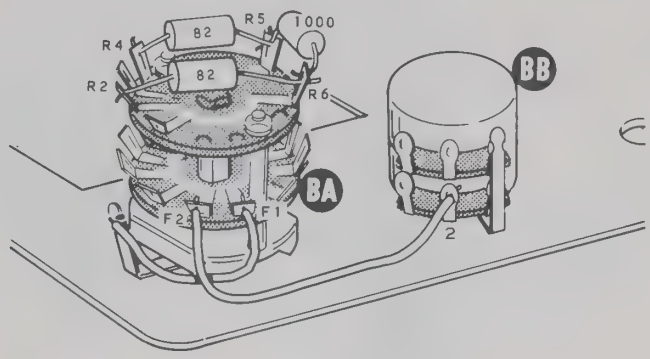
(✓) Mount the dual control and control solder lug at BB as shown in Detail 4C.

(✓) Place a control lockwasher on the bushing of the 2-position rotary switch (#63-177) and install the switch at BD. Use a control flat washer and a control nut.

(✓) Refer to Detail 4D and mount the meter (#407-114) at BC. Use the hardware that is packaged with the meter. Do not overtighten the nuts, or the studs may pull out of the plastic meter case.



Detail 4D



PICTORIAL 5

FRONT PANEL PREWIRING

Refer to Pictorial 5 for the following steps.

NOTE: In the following steps, the lugs of 2-section switch BA are identified by a letter-number combination that indicates the front (F) or rear (R) switch section, and the lug number on that section. For example, lug F2 would be lug #2 on the front section of the switch.

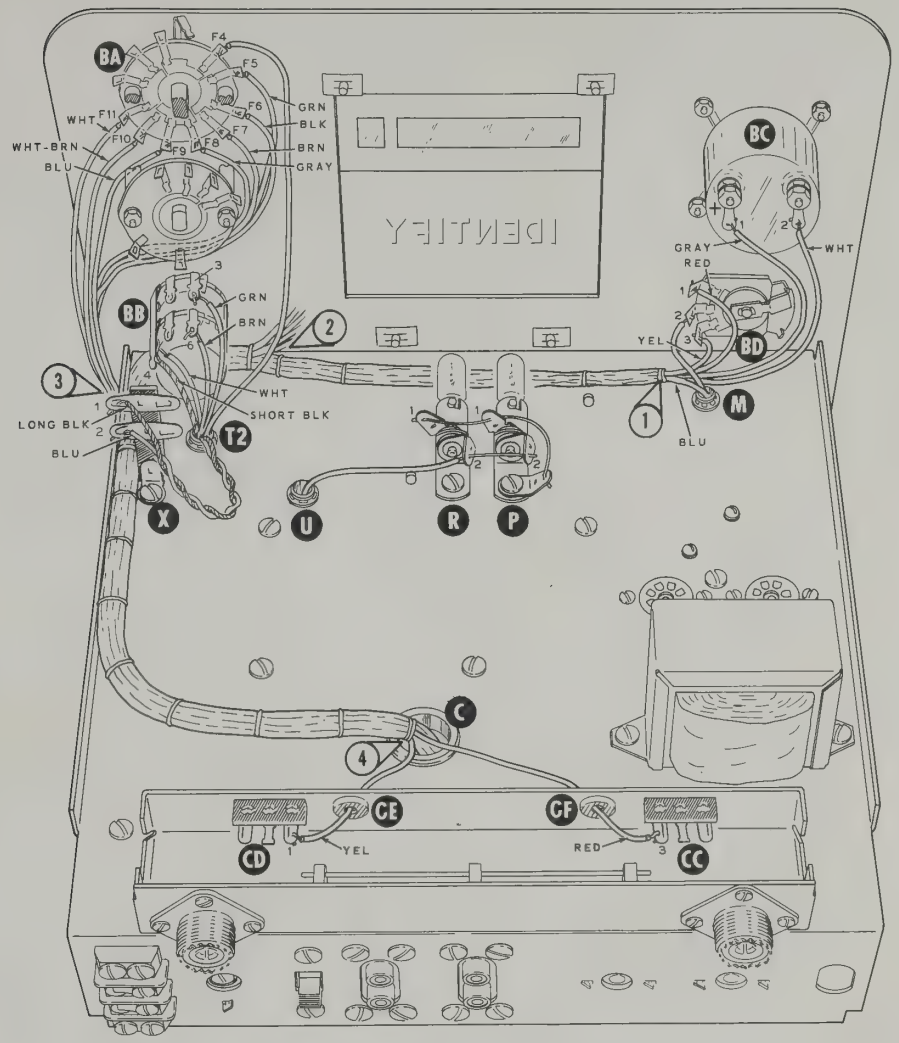
(✓) Connect a 2" hookup wire from the control solder lug (NS) to lug F1 of switch BA (S-1).

(✓) Connect a 4" hookup wire from lug F2 of switch BA (S-1) to lug 2 of dual control BB (S-1).

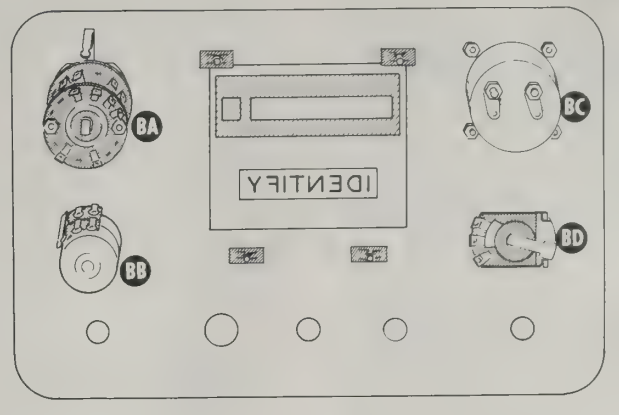
(✓) Connect an 82 Ω (gray-red-black) resistor from lug R2 (NS) to lug R6 (NS) of switch BA. Position the resistor away from the switch wafer as shown in Pictorial 5.

(✓) Connect an 82 Ω (gray-red-black) resistor from lug R4 (NS) to lug R5 (NS) of switch BA. Position the resistor away from the switch wafer and be sure the leads do not touch the switch mounting hardware.

(✓) Connect a 1000 Ω (brown-black-red) resistor from lug R5 (NS) to lug R6 (NS) of switch BA.



PICTORIAL 7



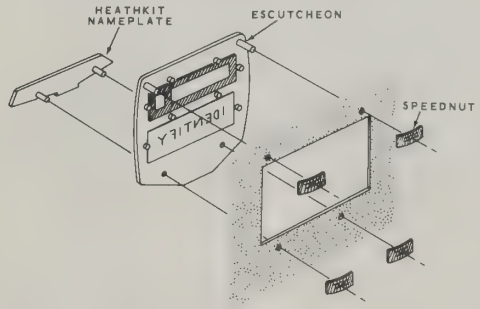
PICTORIAL 4

FRONT PANEL PARTS MOUNTING

Refer to Pictorial 4 for the following steps.

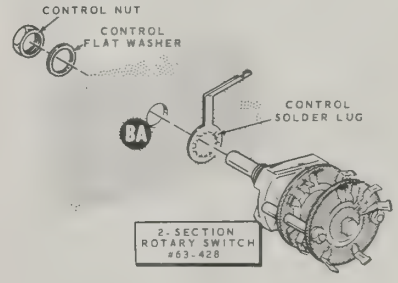
( ) Place the front panel on a towel or soft cloth to avoid scratching its surface, and position the panel as shown. Refer to Pictorial 4 for the correct positioning of the following parts.

( ) Mount the escutcheon and Heathkit nameplate at the rectangular opening in the front panel, as shown in Detail 4A. Press the speednuts carefully, but firmly, onto the escutcheon and nameplate studs.



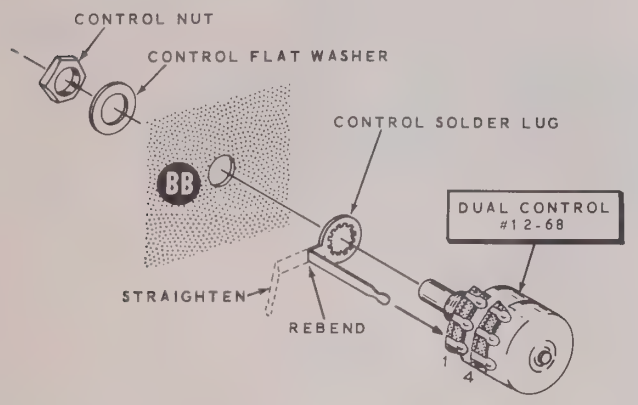
Detail 4A

( ) Refer to Detail 4B and mount the 2-section rotary switch (#63-428) at BA. Position the switch and the control solder lug as shown in Pictorial 4.



Detail 4B

( ) Straighten out a control solder lug and rebend it as shown in Detail 4C. Place the solder lug on the bushing of the dual control (#12-68) and be sure it touches both lug 1 and lug 4 of the dual control.

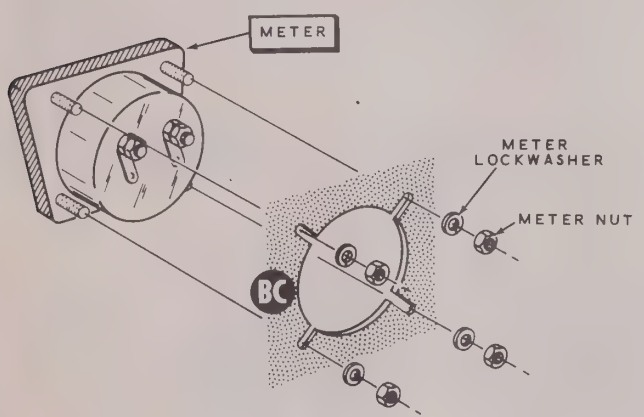


Detail 4C

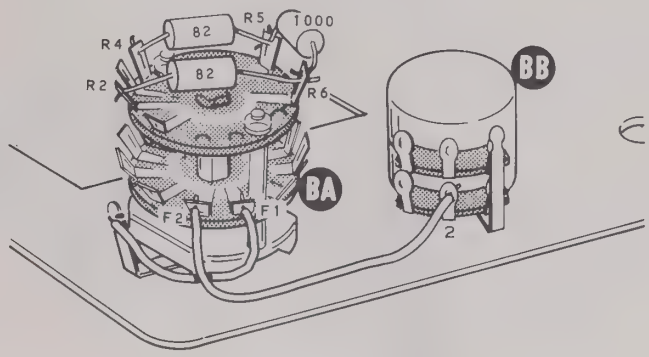
(✓) Mount the dual control and control solder lug at BB as shown in Detail 4C.

(✓) Place a control lockwasher on the bushing of the 2-position rotary switch (#63-177) and install the switch at BD. Use a control flat washer and a control nut.

(✓) Refer to Detail 4D and mount the meter (#407-114) at BC. Use the hardware that is packaged with the meter. Do not overtighten the nuts, or the studs may pull out of the plastic meter case.



Detail 4D



PICTORIAL 5

FRONT PANEL PREWIRING

Refer to Pictorial 5 for the following steps.

NOTE: In the following steps, the lugs of 2-section switch BA are identified by a letter-number combination that indicates the front (F) or rear (R) switch section, and the lug number on that section. For example, lug F2 would be lug #2 on the front section of the switch.

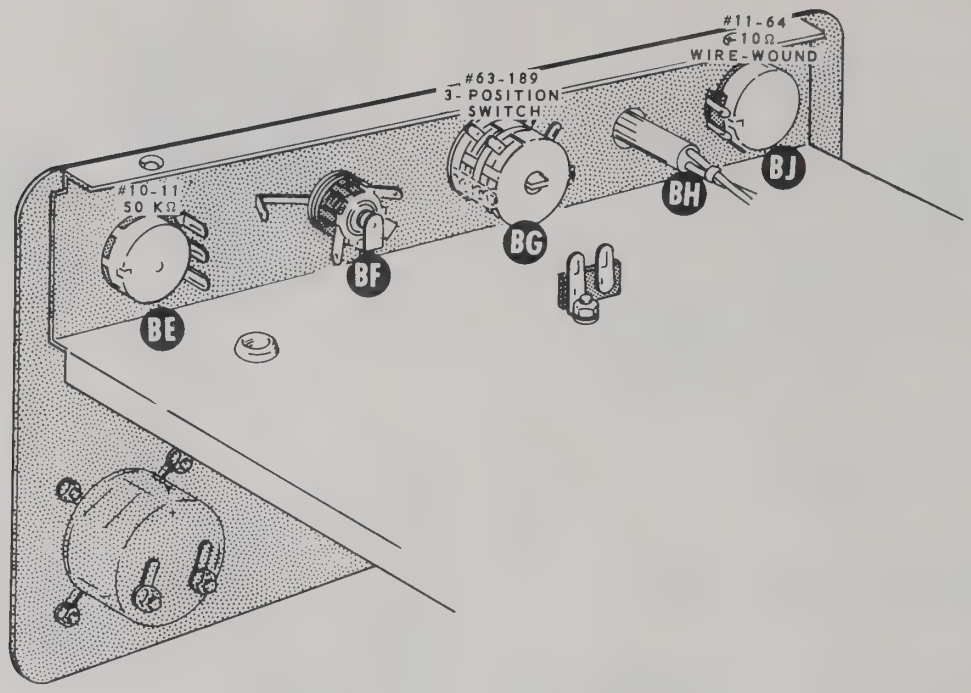
(✓) Connect a 2" hookup wire from the control solder lug (NS) to lug F1 of switch BA (S-1).

(✓) Connect a 4" hookup wire from lug F2 of switch BA (S-1) to lug 2 of dual control BB (S-1).

(✓) Connect an 82 Ω (gray-red-black) resistor from lug R2 (NS) to lug R6 (NS) of switch BA. Position the resistor away from the switch wafer as shown in Pictorial 5.

(✓) Connect an 82 Ω (gray-red-black) resistor from lug R4 (NS) to lug R5 (NS) of switch BA. Position the resistor away from the switch wafer and be sure the leads do not touch the switch mounting hardware.

(✓) Connect a 1000 Ω (brown-black-red) resistor from lug R5 (NS) to lug R6 (NS) of switch BA.



PICTORIAL 6

FRONT PANEL MOUNTING

Refer to Pictorial 6 for the following steps.

( ) Position the front panel against the front of the chassis as shown.

NOTE: As you install the controls and switches in the next four steps, tighten their control nuts only finger-tight. Later, you will be instructed to tighten them securely.

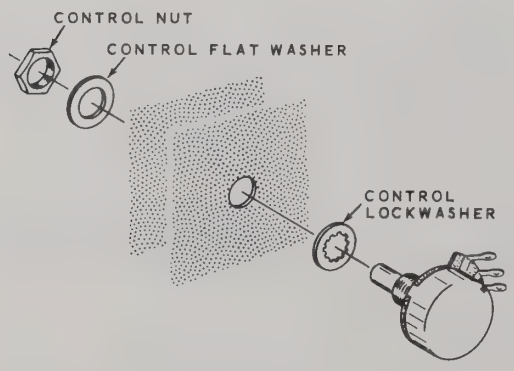
( ) Refer to Detail 6A and install a 50 KΩ control (#10-11) at BE with a control lockwasher, a control flat washer and a control nut. Position the control lugs as shown in Pictorial 6.

( ) Similarly, install a 10 Ω wire-wound control (#11-64) at BJ.

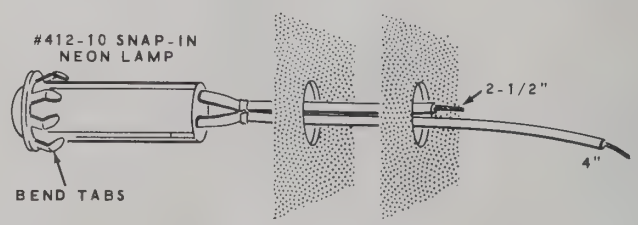
( ) In the same manner, install the 3-position switch (#63-189) at BG.

( ) Cut one lead of the snap-in neon lamp (#412-10) to 4" and cut the other lead to 2-1/2". Measure the leads from where they leave the plastic case. Remove 1/4" of insulation from each lead. Then apply a thin film of solder to the bare wires to hold the strands together.

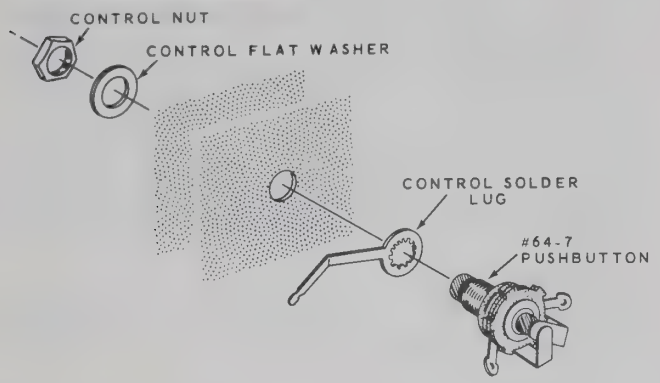
( ) Refer to Detail 6B and bend the tabs of the snap-in neon lamp as shown. Then install the lamp at BH.



Detail 6A



Detail 6B



Detail 6C

( ) Refer to Detail 6C and install the push-button switch (#64-7) at BF with a control solder lug, a control flat washer, and a control nut. Position the switch and solder lug as shown in Pictorial 6.

( ) Check to be sure the lugs of each switch and control are positioned as shown in Pictorial 6. Then tighten their control nuts securely.

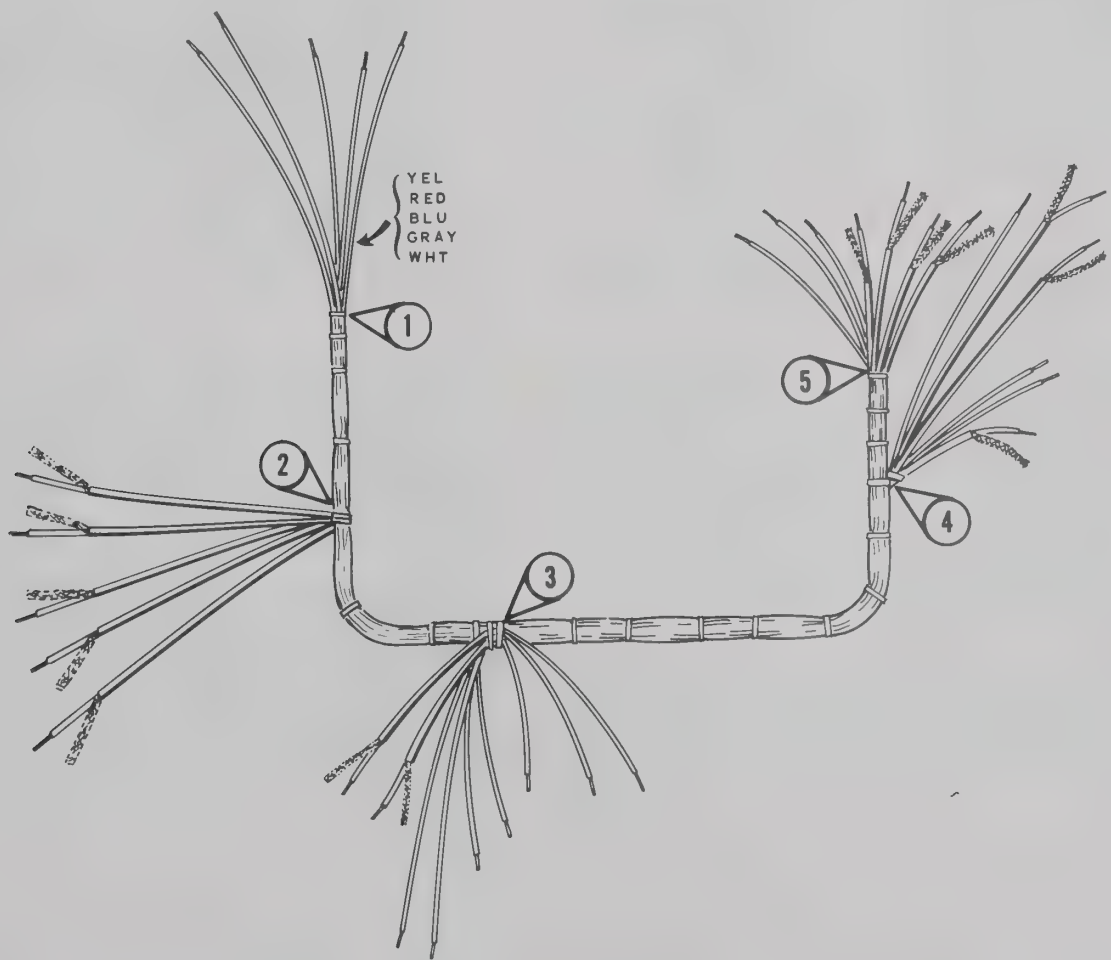
FINAL WIRING-TOP OF CHASSIS

Refer to Pictorial 7 (fold-out from Page 16) for the following steps.

( ) Prepare the harness (#134-141) by twisting together the fine wire strands of the center conductor in each shielded cable. Then melt a very thin film of solder on the end of each center conductor to hold the strands together.

( ) Position the chassis as shown in the Pictorial.

( ) Refer to Detail 7A and locate the five break-outs of the harness. Note that BO#1 (breakout #1) has five long unshielded wires and no shielded cables.



Detail 7A

(✓) At BO#4, bend the red wire and the yellow wire aside. Pass the remaining wires and shielded cables of BO#4 and BO#5 down through grommet C to the bottom of the chassis. They will be connected later.

(✓) Position the harness on top of the chassis with the breakouts as shown in Pictorial 7.

(✓) Pass the blue wire from BO#1 down through grommet M to the bottom of the chassis for connection later.

(✓) Remove 1/4" of insulation from each end of a 7-1/2" hookup wire. Connect one end of this wire to lug F4 of switch BA (S-1). Pass the other end of the wire down through grommet T2 to the bottom of the chassis for connection later.

(✓) Remove 1/4" of insulation from each end of a 4" hookup wire. Connect one end of this wire to lug 2 of switch BD (S-1). Pass the other end of this wire down through grommet M. It will be connected later.

(✓) Remove and discard the wire jumper that is between terminals 1 and 2 of the meter.

Connect the wires from BO#1 in the following steps:

(✓) Connect the white wire to lug 2 (S-1) and the gray wire to lug 1 (S-1) of meter BC.

(✓) Connect the yellow wire to lug 3 (S-1) and the red wire to lug 1 (S-1) of switch BD.

Connect the leads that come from grommet T2 to the lugs of dual control BB as follows:

(✓) Green to lug 3 (NS).

(✓) Brown to lug 6 (S-1).

(✓) Short black to lug 4 (NS).

(✓) White to lug 4 (NS).

(✓) Connect the blue lead that comes from grommet T2 to lug 2 (S-1) and the long black lead to lug 1 (S-1) of terminal strip X.

Connect the seven wires from BO#3 to the front section lugs of switch BA as follows:

(✓) Green to F5 (S-1).

(✓) Black to F6 (S-1).

(✓) Brown to F7 (S-1).

(✓) Gray to F8 (S-1).

(✓) Blue to F9 (S-1).

(✓) White-brown to F10 (S-1).

(✓) White to F11 (S-1).

(✓) At BO#4, pass the red wire and the yellow wire through the grommets in the SWR bridge base as shown in Pictorial 7.

(✓) Connect the yellow wire to lug 1 of terminal strip CD (S-3).

(✓) Connect the red wire to lug 3 of terminal strip CC (S-3).

(✓) Remove all the insulation from a 2-1/2" hookup wire. Connect this wire from lug 1 of pilot lamp socket R (S-1), through lug 1 of pilot lamp socket P (S-2), to solder lug P (S-1). Position the wire as shown in Pictorial 7.

(✓) Remove 1-1/4" of insulation from one end of a 7-1/2" hookup wire. Pass this end through lug 2 of pilot lamp socket R (S-2), to lug 2 of pilot lamp socket P (S-1). Pass the other end down through grommet U. It will be connected later.

Refer to Pictorial 8 for the following steps.

NOTE: When you connect the shielded cables in the following steps, first connect and solder only the center conductors. Then connect the cable shields in a separate step. Only the cable color, lug number, and soldering instructions will be given in these steps.

Connect the two shielded cables from BO#3 to the lugs of dual control BB as follows:

( ) Green to lug 3 (S-2).

( ) White to lug 5 (S-1).

( ) Both shields to lug 4 (S-5). Be sure to solder the control solder lug along with the two shield leads and two wires to lug 4 of the control.

( ) Solder the control solder lug to lug 1 of control BB (S-1).

Connect the five shielded cables from BO#2 to the lugs of switch BA as follows:

( ) Brown to F3 (S-1).

( ) Blue to R4 (S-2).

( ) Black to R3 (S-1).

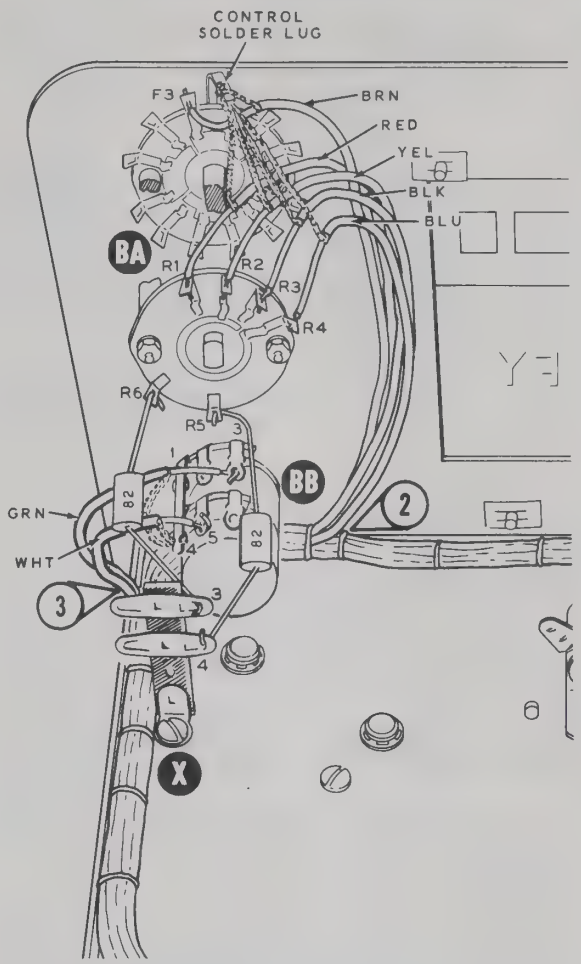
( ) Yellow to R2 (S-2).

( ) Red to R1 (S-1).

( ) Wrap all five shield leads around the control solder lug and solder them, along with the hookup wire that was connected previously (S-6).

( ) Connect an 82 Ω (gray-red-black) resistor from lug R5 of switch BA (S-3) to lug 4 of terminal strip X (S-1).

( ) Connect an 82 Ω (gray-red-black) resistor from lug R6 of switch BA (S-3) to lug 3 of terminal strip X (S-1).



PICTORIAL 8

This completes the wiring and soldering on the top of the chassis and on the front panel. Carefully examine the lugs and wires to be sure that all connections are soldered, and that there are no short circuits. Only one lug on each of the two terminal strips in the SWR bridge should remain without a connection.

Tip the chassis upside down and shake it to dislodge any bits of solder, or wire ends, that may have fallen into the wiring. Now proceed with the Final Wiring on the bottom of the chassis.

FINAL WIRING-BOTTOM OF CHASSIS

Refer to Pictorial 9 (fold-out from Page 25) for the following steps.

Connect the wires coming from grommet C as follows:

( ) Brown to lug 2 of terminal strip B (S-2).

( ) White-brown to lug 5 of switch AC (S-1).

( ) Green to lug 3 of double phono socket AE (S-1).

( ) Black to lug 2 of double phono socket AE (S-1).

Connect the shielded cables that come from grommet C as follows:

( ) Blue: center lead to lug 4 of terminal strip B (S-2). Place 1/2" of sleeving on the shield lead, then connect the shield lead to lug 3 of terminal strip B (NS).

( ) Black: center lead to lug 1 (S-2) and shield lead to lug 3 (S-2) of terminal strip B.

( ) Red: center lead to lug 3 (S-2) and shield lead to the lower hole (S-1) in terminal strip A.

( ) Brown: shield lead to lug 4 (S-1) and center lead to lug 3 (S-1) of double phono socket AD.

( ) White: center lead to lug 2 (S-1) and shield lead to lug 1 (S-2) of double phono socket AD.

( ) Yellow: center lead to lug 6 (S-1) and shield lead to lug 4 (NS) of switch AC.

( ) Green: center lead to lug 1 (S-1) and shield lead to lug 4 (S-3) of switch AC.

( ) Inspect the wiring around the rear of the chassis and be sure the shield leads do not touch any ungrounded leads or terminals.

( ) Connect the two wires that come from grommet M as follows: black to lug 3 (S-1) and blue to lug 2 (S-1) of control BE.

( ) Remove 1/4" of insulation from the hookup wire that comes from grommet U. Then connect this wire to lug 3 of switch BG (NS).

( ) Twist together the red wire and black wire from the 3-conductor shielded cable. Connect the red wire to lug 1 (NS) and the black wire to lug 2 (NS) of switch BG.

( ) Connect the longer lead from neon pilot lamp BH to lug 1 of switch BG (S-2) and the shorter lead to lug 1 of terminal strip P (NS).

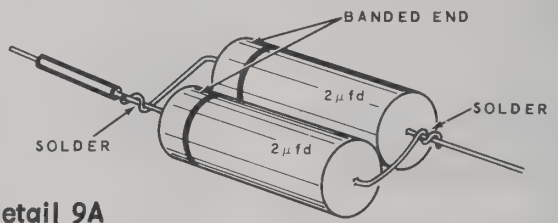
( ) Connect the hookup wire that comes from grommet T2 to lug 1 of control BJ (S-1).

( ) Twist together the two green leads from transformer T1. Connect either green lead to lug 2 (S-1) and the other to lug 3 (NS) of control BJ.

( ) Connect a 3-1/2" hookup wire from lug 3 of control BJ (S-2) to lug 2 of terminal strip W (NS).

( ) Connect a 10 KΩ (brown-black-orange) resistor from lug 2 of pushbutton switch BF (S-1) to the control solder lug (NS).

Refer to Detail 9A and prepare a combination of two 2 μfd tubular capacitors as shown.



Detail 9A

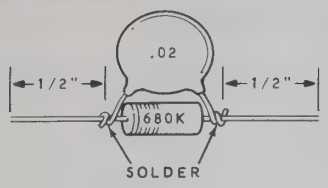
( ) Place a 1" length of sleeving on the lead from the banded end of the capacitor combination. Connect this lead to lug 2 of terminal strip W (S-2).

( ) Connect the lead from the unmarked end of the capacitor combination to lug 4 of terminal strip L (NS).

( ) Install a neon lamp (#412-34) as shown in Pictorial 9. Connect the lead from the color dot to lug 4 (NS) and the other lead to lug 5 (S-3) of terminal strip L.

( ) Prepare a .02 μfd disc capacitor and a 680 KΩ (blue-gray-yellow) resistor as shown in Detail 9B.

( ) Connect one lead of the resistor-capacitor combination to lug 1 of tube socket V1 (S-2). Then connect the other lead to lug 7 of tube socket V2 (S-2).



Detail 9B

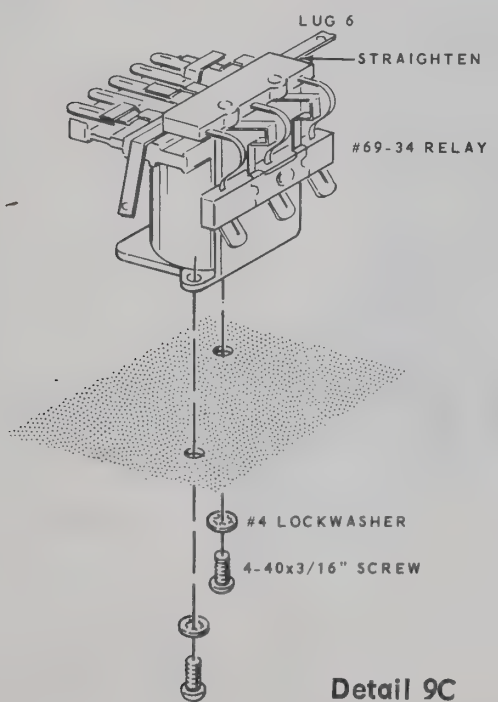
( ) Connect a 22 KΩ (red-red-orange) 2 watt resistor from lug 1 of tube socket V2 (S-1) to lug 1 of terminal strip H (NS). Position the resistor as shown.

( ) Place 3/4" of sleeving on the lead from the positive (+) end of a 100 μfd electrolytic capacitor. Connect this lead to lug 2 of terminal strip E (NS). Connect the other lead to lug 4 of terminal strip H (S-2).

( ) Place 1/2" of sleeving on the lead from the negative (-) end of a 100 μfd electrolytic capacitor. Connect this lead to lug 2 of terminal strip E (S-4). Connect the positive (+) lead to lug 1 of terminal strip H (S-3).

( ) Connect the slow-blow fuse (#421-40) from lug 5 of terminal strip E (S-3) to lug 6 of terminal strip H (NS).

( ) Refer to Detail 9C and straighten out lug 6 of the DPDT relay (#69-34). Mount the relay on the bottom of the chassis at K. Use 4-40 x 3/16" screws and #4 lockwashers. Position the relay as shown in Pictorial 9.



Detail 9C

( ) Prepare the following lengths of hookup wire:

4-1/2"	5"
1-3/4"	4-1/2"
5"	5-1/2"
3"	

( ) Remove an extra 1/2" of insulation from one end of the 4-1/2" hookup wire. Connect this end through lug 1 of control BE (S-2) to the adjoining control solder lug (S-2). Connect the other end of this wire to lug 8 of relay K (S-1).

( ) Connect a 1-3/4" wire from lug 2 (S-1) to lug 10 (NS) of relay K.

( ) Connect a 5" wire from lug 10 of relay K (S-2) to lug 6 of tube socket V1 (S-3). Position this wire against the chassis along terminal strip L, as shown.

( ) Connect a 3" wire from lug 7 of relay K (S-1) to lug 4 of tube socket V1 (S-2). Position this wire along the chassis between the relay and terminal strip J.

( ) Connect a 5" wire from lug 1 of pushbutton switch BF (S-1) to lug 6 of relay K (NS).

( ) Place 1" of sleeving on each lead of a 10 KΩ (brown-black-orange) resistor. Connect this resistor from lug 9 of relay K (S-1) to lug 1 of terminal strip L (S-2).

( ) Connect a 47 KΩ (yellow-violet-orange) resistor from lug 1 of relay K (S-1) to lug 2 of terminal strip L (S-3).

( ) Connect a 1000 Ω (brown-black-red) resistor from lug 3 of relay K (S-1) to lug 4 of terminal strip L (S-4).

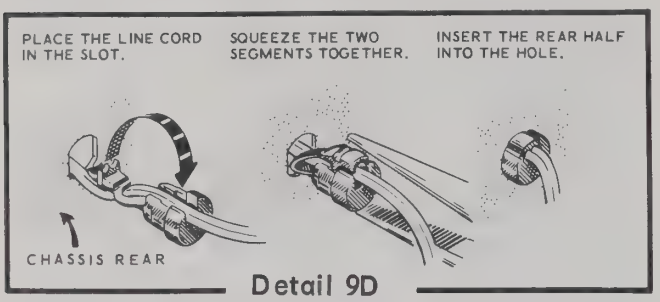
( ) Connect a 10 KΩ (brown-black-orange) resistor from lug 6 of relay K (S-2) to lug 5 of tube socket V1 (S-1).

( ) Connect a 4-1/2" wire to lug 4 (S-1) and a 5-1/2" wire to lug 3 (S-2) of switch BG. Then twist these two wires together for four or five turns. Connect the free end of the 4-1/2" wire to lug 2 of buzzer D (S-1). Connect the free end of the 5-1/2" wire to lug 5 of relay K (S-1).

(✓) Separate the two leads of the line cord for about 2". Twist the fine strands of each lead together and apply a thin film of solder to the ends of the wires.

(✓) Pass the end of the line cord through hole AH and connect one wire to lug 6 of terminal strip E (S-2). Connect the other line cord wire to lug 6 of terminal strip H (S-2).

(✓) Install the line cord strain relief (#75-24) in hole AH, as shown in Detail 9D.



Detail 9D

CLOCK INSTALLATION

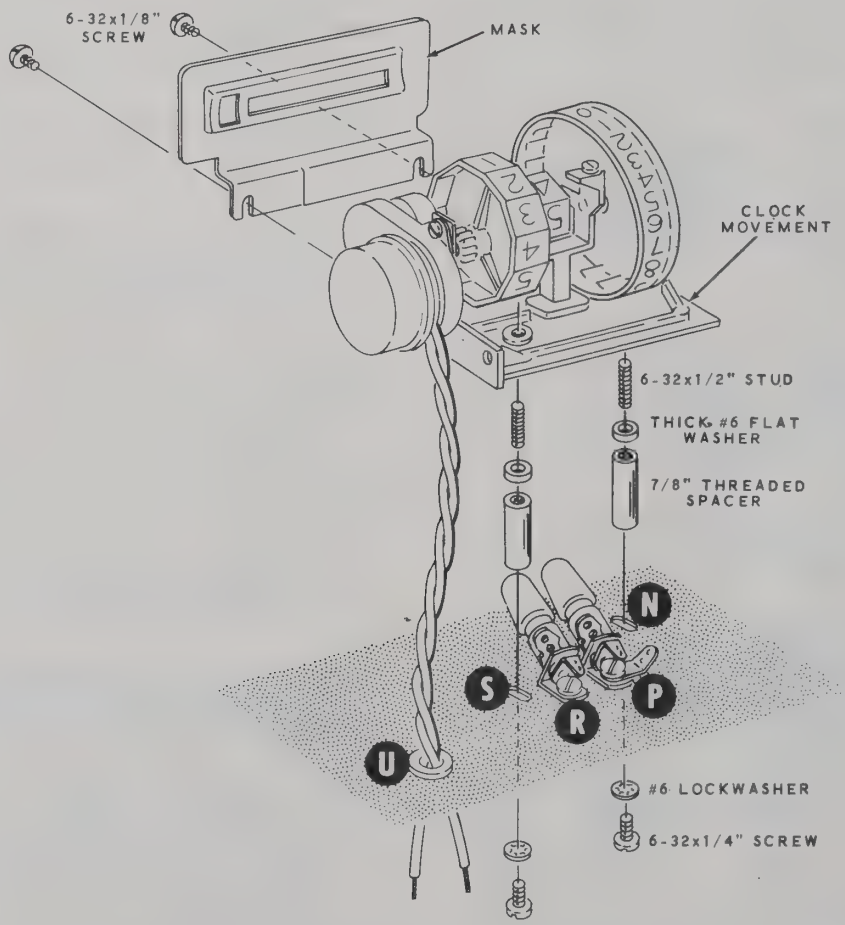
Refer to Pictorial 10 and Detail 10A for the following steps.

(✓) Carefully unpack the clock movement (#406-49). Remove and discard the two 6-32 x 1/8" screws and the white mask from the front of the clock movement.

(✓) Twist together the fine wire strands at the end of each clock motor lead. Then apply a thin film of solder to the end of each lead to hold the fine wire strands together.

(✓) Screw a 6-32 x 1/2" stud approximately 1/8" into each of the two threaded holes in the bottom of the clock base.

(✓) Place a thick #6 flat washer on each stud, then screw a 7/8" threaded spacer onto each stud.



Detail 10A

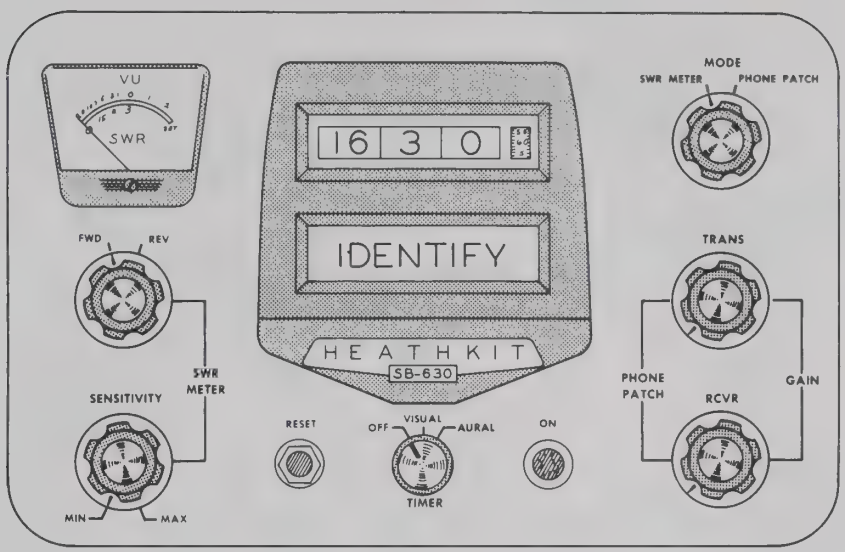


FIGURE 1

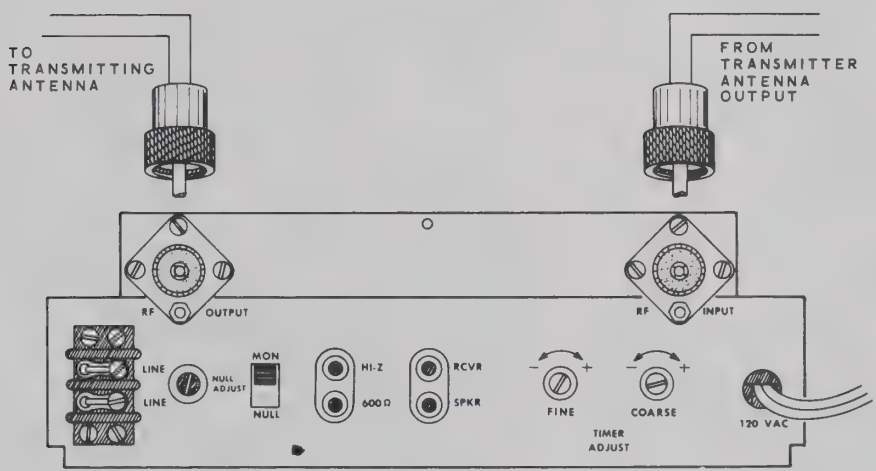
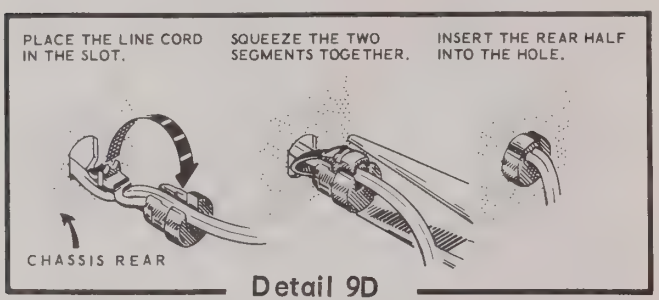


FIGURE 2

(✓) Separate the two leads of the line cord for about 2". Twist the fine strands of each lead together and apply a thin film of solder to the ends of the wires.

(✓) Pass the end of the line cord through hole AH and connect one wire to lug 6 of terminal strip E (S-2). Connect the other line cord wire to lug 6 of terminal strip H (S-2).

(✓) Install the line cord strain relief (#75-24) in hole AH, as shown in Detail 9D.



Detail 9D

CLOCK INSTALLATION

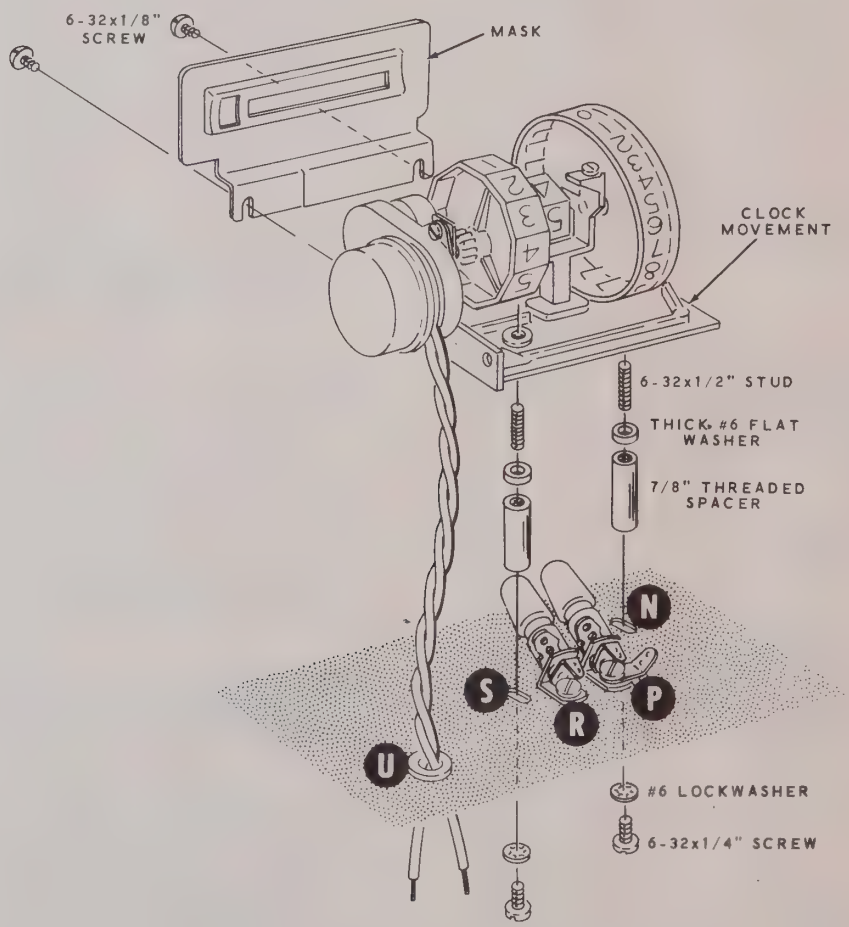
Refer to Pictorial 10 and Detail 10A for the following steps.

(✓) Carefully unpack the clock movement (#406-49). Remove and discard the two 6-32 x 1/8" screws and the white mask from the front of the clock movement.

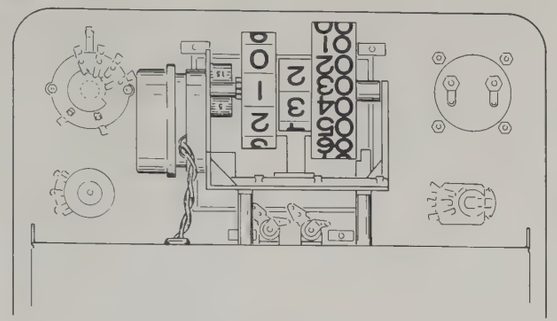
(✓) Twist together the fine wire strands at the end of each clock motor lead. Then apply a thin film of solder to the end of each lead to hold the fine wire strands together.

(✓) Screw a 6-32 x 1/2" stud approximately 1/8" into each of the two threaded holes in the bottom of the clock base.

(✓) Place a thick #6 flat washer on each stud, then screw a 7/8" threaded spacer onto each stud.



Detail 10A



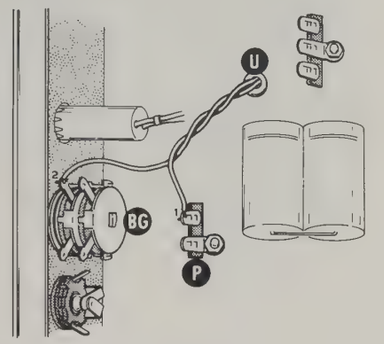
PICTORIAL 10

(✓) Mount the clock on the top of the chassis with 6-32 x 1/4" screws and #6 lockwashers at N and S. Position the clock dials parallel with the front panel, with the seconds dial at least 1/16" from the inside of the escutcheon, before you tighten the screws.

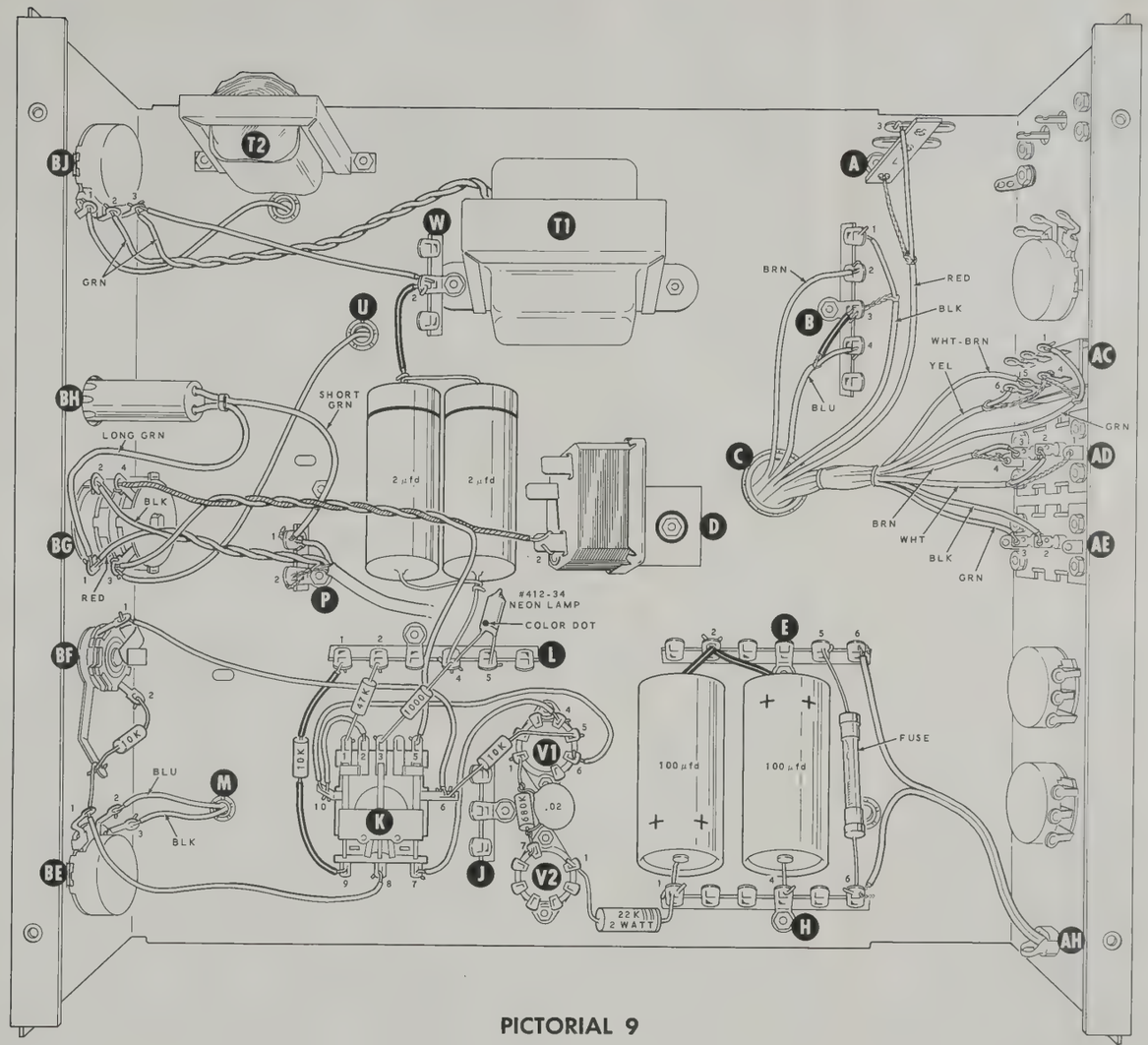
(✓) Twist together the two leads from the clock motor. Pass these leads down through grommet U to the bottom of the chassis.

(✓) Turn the chassis on its side as shown in Detail 10B. Connect one of the clock motor leads to lug 2 of switch BG (S-2) and the other lead to lug 1 of terminal strip P (S-3).

This completes the wiring and soldering in your kit. Carefully examine the connections on the bottom of the chassis to be sure of good solder joints, and to see that no short circuits exist between wires or connections. Shake the chassis to dislodge any bits of solder or wire ends that may have dropped into the wiring during assembly.



Detail 10B



PICTORIAL 9

KNOB AND TUBE INSTALLATION

Refer to Pictorial 11 for the following steps.

NOTE: In the following steps, use the #8 allen wrench to tighten the setscrews in the skirted knobs.

( ) Start an 8-32 x 1/4" setscrew into the threaded hole of each of the five skirted knobs.

( ) Install skirted knobs on the shafts of the FWD/REV and MODE switches so their pointers are at the left-hand mark on the panel.

( ) Check to be sure each knob will indicate both positions when turned. If either knob will not indicate correctly; turn it to the counterclockwise position and loosen the setscrew. Then set the pointer to the left-hand mark on the panel, and retighten the setscrew.

( ) In a similar manner, install the small black knob on the shaft of the TIMER switch. Use a small screwdriver to tighten the setscrew.

( ) Turn the shafts of all remaining front panel controls to the full counterclockwise position.

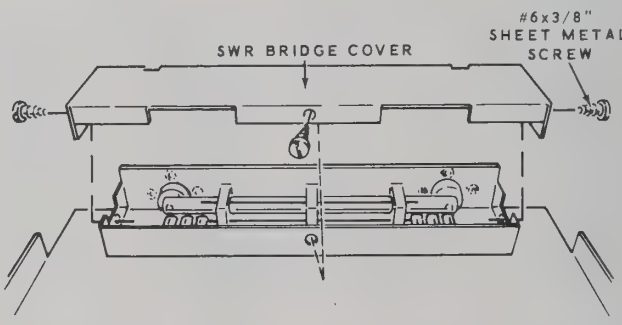
( ) Install a skirted knob with the pointer at the 7 o'clock position, or to the full counterclockwise mark on the front panel, on each of the remaining shafts. (SENSITIVITY, TRANS, RCVR).

( ) Install the 6EW6 tube in tube socket V1.

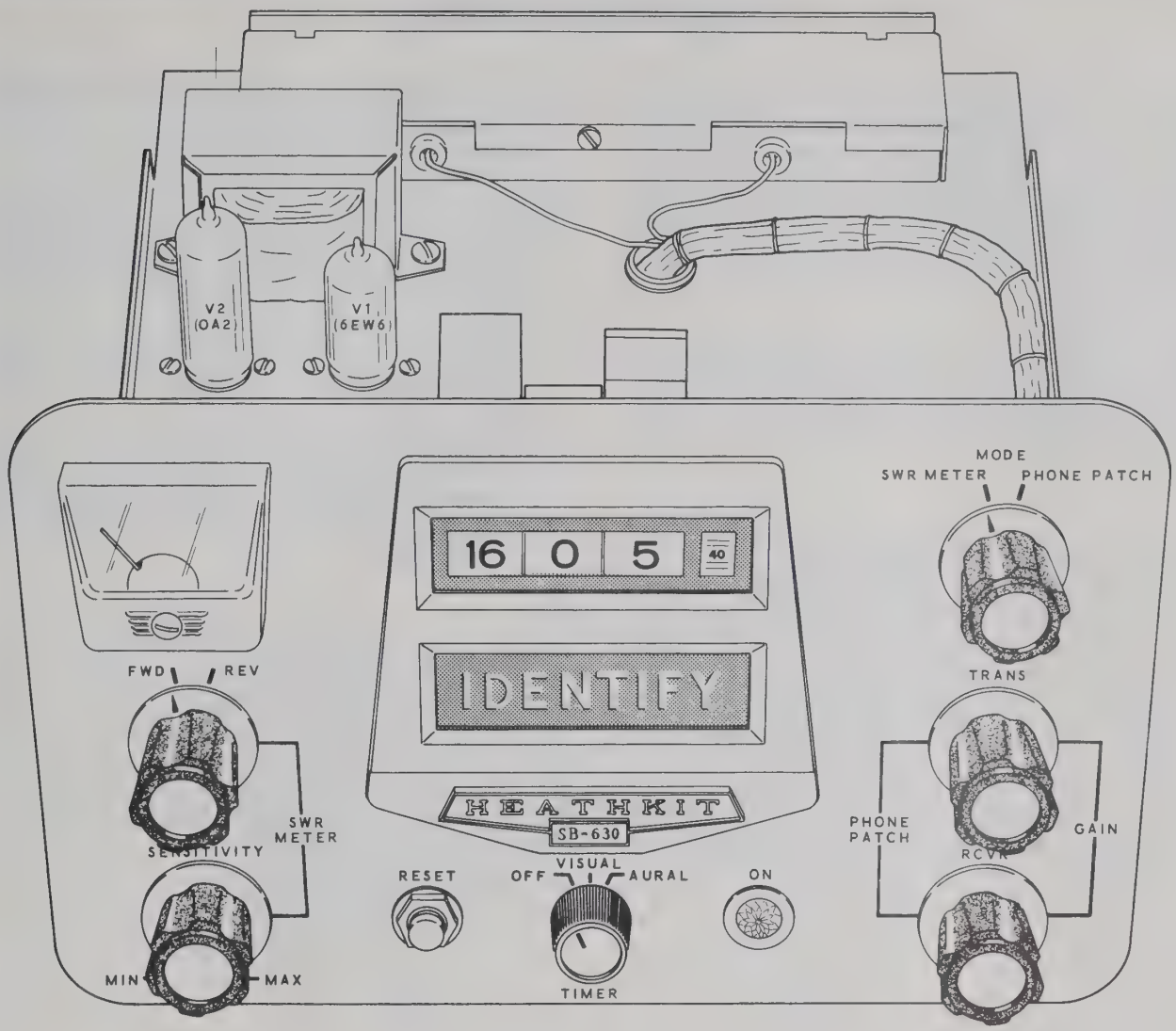
( ) Install the OA2 tube in tube socket V2.

( ) Refer to Detail 11A and install the SWR bridge cover on the SWR bridge subassembly. Use #6 x 3/8" sheet metal screws.

( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the rear of the SWR bridge assembly. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



Detail 11A



PICTORIAL 11

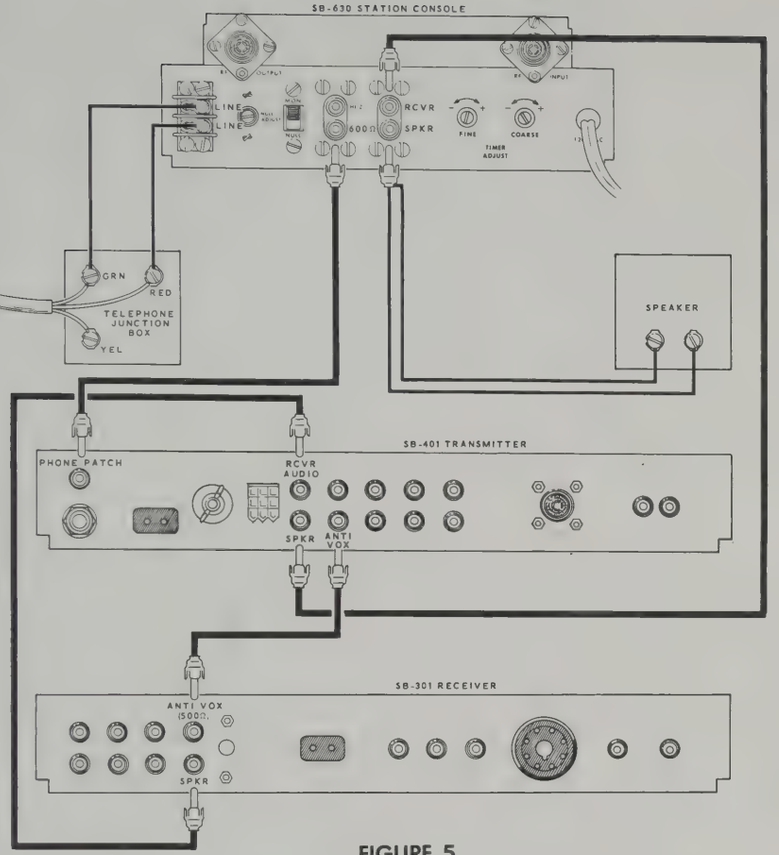


FIGURE 5

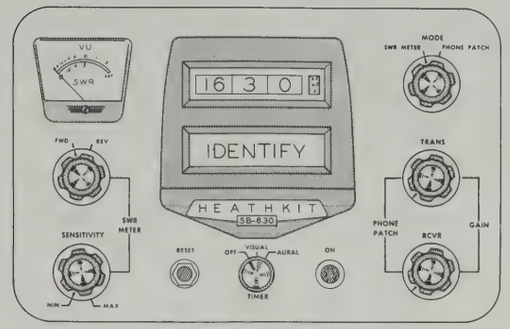


FIGURE 1

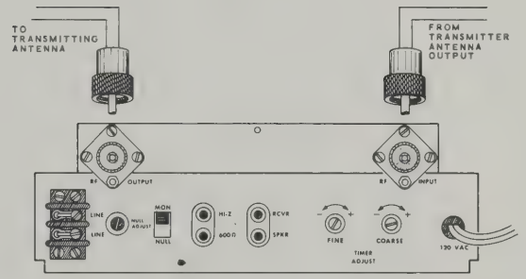


FIGURE 2

KNOB AND TUBE INSTALLATION

Refer to Pictorial 11 for the following steps.

NOTE: In the following steps, use the #8 allen wrench to tighten the setscrews in the skirted knobs.

(✓) Start an 8-32 x 1/4" setscrew into the threaded hole of each of the five skirted knobs.

(✓) Install skirted knobs on the shafts of the FWD/REV and MODE switches so their pointers are at the left-hand mark on the panel.

(✓) Check to be sure each knob will indicate both positions when turned. If either knob will not indicate correctly; turn it to the counterclockwise position and loosen the setscrew. Then set the pointer to the left-hand mark on the panel, and retighten the setscrew.

(✓) In a similar manner, install the small black knob on the shaft of the TIMER switch. Use a small screwdriver to tighten the setscrew.

(✓) Turn the shafts of all remaining front panel controls to the full counterclockwise position.

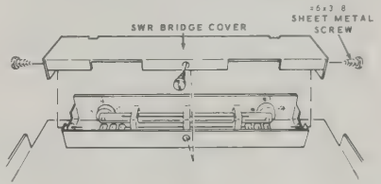
(✓) Install a skirted knob with the pointer at the 7 o'clock position, or to the full counterclockwise mark on the front panel, on each of the remaining shafts. (SENSITIVITY, TRANS, RCVR).

(✓) Install the 6EW6 tube in tube socket V1.

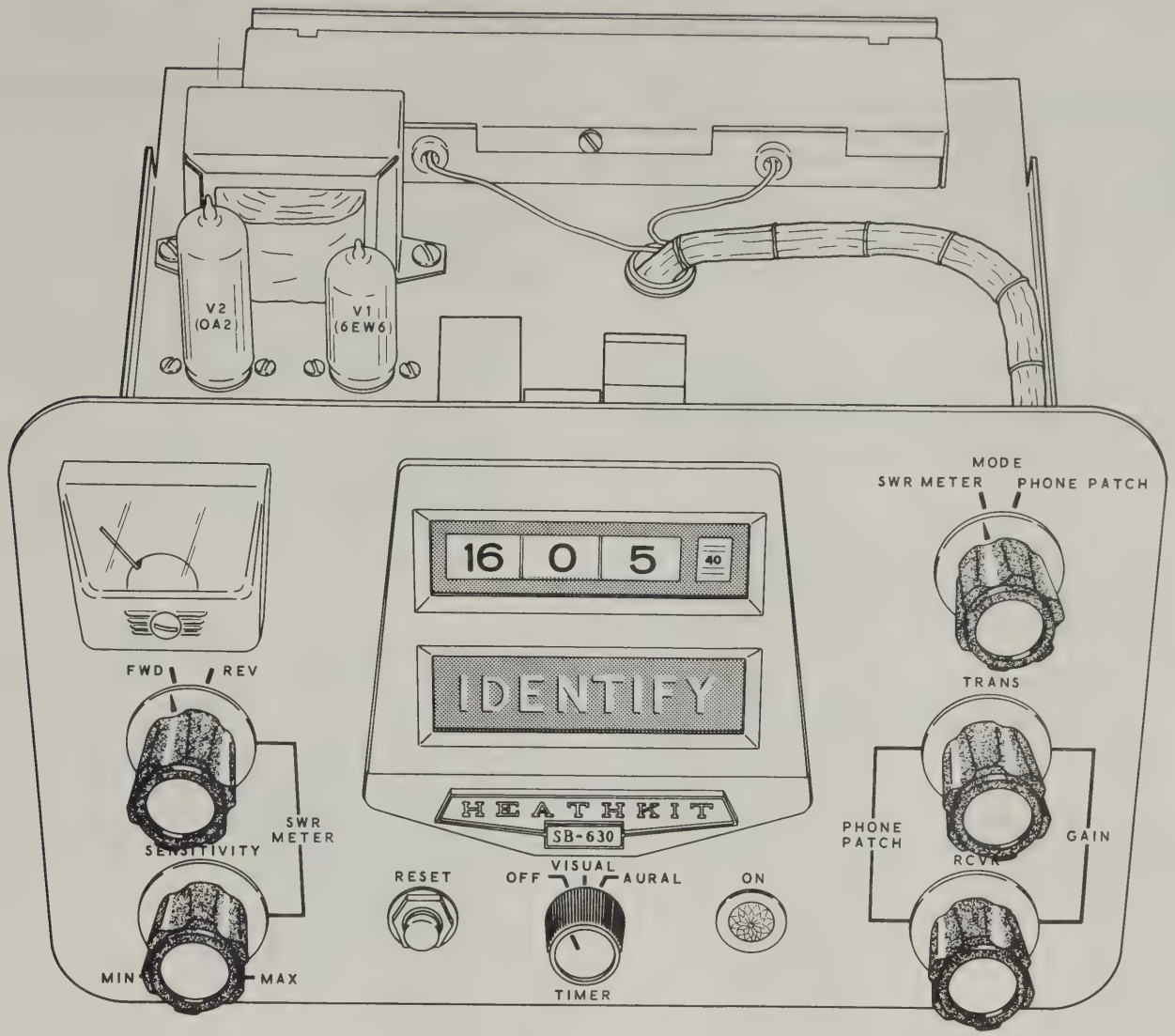
(✓) Install the OA2 tube in tube socket V2.

(✓) Refer to Detail 11A and install the SWR bridge cover on the SWR bridge subassembly. Use #6 x 3/8" sheet metal screws.

(✓) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the rear of the SWR bridge assembly. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



Detail 11A



PICTORIAL 11

INITIAL TEST

Before you connect the line cord to the AC outlet, be sure all front panel controls and switches are in their full counterclockwise position. Refer to Figure 1 (fold-out from Page 26). Should the desired results not be obtained in any of the following tests, unplug the line cord at once and refer to the In Case Of Difficulty section on Page 37.

NOTE: This Manual uses the new IEEE (Institue of Electrical and Electronic Engineers) and international standard term "hertz" as the basic unit of frequency. The terms are used as follows:

Hz (hertz) = cps (cycles per second).
kHz (kilohertz) = kc (kilocycles per second).
MHz (megahertz) = mc (megacycles per second).

( ) Connect the line cord to a 120 V AC 60 Hz outlet. The clock should run, but the tubes and the ON pilot lamp should not light.

( ) Turn the TIMER switch to VISUAL. The ON pilot lamp should light and begin to warm up.

( ) After about 30 seconds, press the RESET button. The IDENTIFY window should light.

( ) Turn the TIMER switch to AURAL and press the RESET button. Now the buzzer should sound and the IDENTIFY window should light.

( ) Set both TIMER ADJUST controls to the center of their rotation. These controls are located on the rear of the chassis.

( ) Momentarily press and release the RESET button and note the time. After approximately ten minutes, the buzzer should sound and the IDENTIFY window should light for one second.

This completes the Initial Tests of the timer circuits. The reflected power and SWR meter, and the phone patch sections of the Console will be tested in actual operation. If you wish to test these sections with your station equipment before you install the Console in its cabinet, turn to the Installation and Operation section on Page 30. Then, return to the Final Assembly instructions.

FINAL ASSEMBLY

Refer to Pictorial 12 for the following steps.

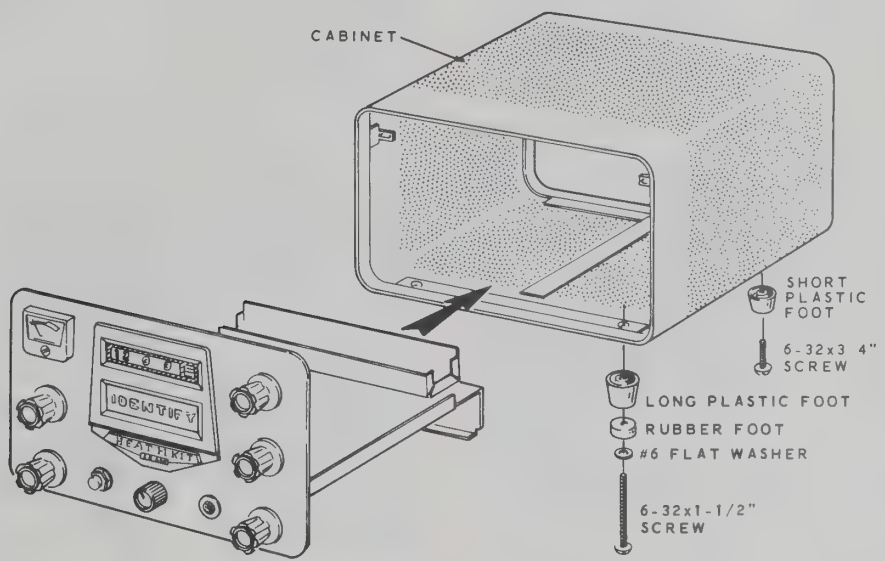
Two sizes of plastic feet and four rubber feet are supplied so the Console can be set level, or tilted upward or downward. Pictorial 12 shows the feet and hardware used for a typical installation, and provides a tilt to match other Heathkit SB series equipment.

( ) Choose the type of feet needed to support the Console at the angle you prefer.

( ) Slide the Console into the cabinet.

( ) Fasten the Console in the cabinet with the foot mounting screws and appropriate feet (and washers if used). Use 6-32 x 3/4" screws and #6 flat washers with the rubber feet, and 6-32 x 3/4" screws with the short plastic feet. Use 6-32 x 1-1/2" screws with the long plastic feet.

Save the two extra screws and any feet or washers not used. You may want to change the tilt of your Console later.



PICTORIAL 12

INSTALLATION AND OPERATION

The digital electric clock, the ten-minute timer, the SWR meter, and the phone patch, are independent sections within the Station Console. The installation and operation of each of these sections will be presented separately. Figure 1 (fold-out from Page 26) shows the location of front panel controls and switches. Figure 2 shows the connectors, jacks, controls, and switch located on the rear of the chassis.

DIGITAL ELECTRIC CLOCK

Installation

No special installation of the clock is required, since it runs whenever the line cord is connected to a 120 volt 60 Hz AC power line.

Operation

To set the clock, rotate the numbered minute and hour drums until the correct time appears in the window of the escutcheon. Do not move the drums when the seconds indicator is near 60. If you desire to set the seconds drum to an accurate time standard (National Bureau of Standards station WWV, for example), disconnect the line cord from the AC power line and wait for the time standard seconds to match the seconds indicated on the clock. Then plug in the line cord and set the minute and hour drums as before.

TEN-MINUTE TIMER

Installation

Connect the line cord to a 120 volt 60 Hz AC power line. The ten-minute timer requires no other installation.

Operation

Turn the TIMER switch to either VISUAL or AURAL. The neon pilot lamp will indicate that the timer is on. Press the RESET button. After a time interval of approximately ten minutes, slowly turn the Coarse control until the IDENTIFY window in the escutcheon lights. The IDENTIFY window will light and the buzzer will sound when the TIMER switch is in the AURAL position.

NOTE: The timer measures an interval that begins when the RESET button is pressed, or when the TIMER switch is turned from Off to either VISUAL or AURAL. To increase the timing interval, turn the TIMER ADJUST controls clockwise. To decrease the interval, turn the controls counterclockwise. The Coarse control permits you to adjust the time interval to within a minute, and the Fine control allows adjustment to within seconds of the desired interval.

The timed interval repeats automatically after the IDENTIFY window lights or the buzzer sounds. The time interval will restart at any time during the cycle if the RESET button is pressed.

When the timer is used with an amateur station, it is a good practice to press the RESET button at the beginning of a transmission. The IDENTIFY light or the buzzer will remind the operator to give his station identification, or call letters, every ten minutes.

The TIMER switch can be left in the OFF position when the timer is not in use, since the ten-minute timer has no effect on the SWR meter or phone patch sections of the Console.

SWR METER

Installation

The SWR meter section of the Console connects between the transmitter output and the antenna transmission line with standard coaxial connectors. The meter can be used with either 50-52 Ω or 70-75 Ω transmission lines, depending on the values of resistors R1 and R2 that were installed in the SWR bridge during assembly. The meter will not perform properly in transmission lines of other impedance, or with lines that are used as tuned feeders. No AC power is needed to operate the SWR meter.

( ) Cut the coaxial transmission line at a place that will allow the Console to set at a convenient location. Install male coaxial connectors on the cable ends.

( ) Connect the transmitter output cable to the RF Input connector and connect the antenna cable to the RF Output connector on the rear of the Console. See Figure 2.

NOTE: If an antenna tuner is used, connect the SWR meter between the transmitter and the antenna tuner with coaxial cable of proper impedance. Then the tuner can be adjusted for maximum output and minimum standing wave ratio.

Operation

Before you apply power to the transmitter, turn the MODE switch to SWR METER, the SWR METER switch to FWD, and the SENSITIVITY control to MIN.

1. Turn on the transmitter and tune it. Disregard any SWR Meter readings during transmitter tuning.

2. After the transmitter is tuned, and with power still applied, set the SENSITIVITY control for a midscale reading on the SWR meter.

NOTE: You may wish, at this time, to "touch up" the tuning of the transmitter. If this "touch up" increases your output, as shown by an increase in the SWR meter reading, you will have obtained a closer match between the transmitter and the transmission line.

3. Set the SENSITIVITY control to give a full-scale (SET) meter reading.

4. Turn the SWR METER switch to REV. The standing wave ratio (SWR) can now be read directly on the meter.

NOTE: The SWR meter can be switched between FWD and REV during transmission and no switching transient will result, since the switch is connected in a low-power bridge circuit. The SWR meter may be left connected in the transmission line at all times for continuous monitoring purposes.

Normal Operating Characteristics

The minimum transmitter output power that is needed to operate the SWR meter varies with frequency. 70 watts are needed for full-scale deflection on 75 meters with the SWR METER switch in the FWD position, while only 2 or 3 watts are required for full-scale deflection on 6 meters. At low power levels where full-scale deflection cannot be obtained, the reflected power indicated with the switch in the REV position will be approximately proportional to the ratio between the actual and full-scale FWD meter readings. For example, if the transmitter output power will only drive the meter to 70% of full scale, then the SWR that you read on the meter in the REV position will only be 70% of the actual SWR in your transmission line.

As the transmitter is voice modulated, the meter will deflect downward slightly. This will occur when the SWR METER switch is in the FWD position; it should not be confused with downward modulation. This effect is generally due to a nonlinear relationship between the voltage and current in the final amplifier of the transmitter, and should not alarm the operator since it is entirely normal with high level modulation.

Control carrier modulation will "kick" the meter indication upward on peaks. SSB and DSB signals will give a bouncing indication when transmitting, so no SWR measurement can be made. Therefore, use a single-tone or CW carrier with sideband transmitters when taking readings. When operating SSB, any meter indication with no modulation indicates spurious or parasitic emission, or poor carrier suppression.

Physical Placement and Losses

The meter readings may vary if the SWR meter is placed at different locations in the transmission line, or if the length of the transmission line is changed. For this reason, assume that the highest SWR reading is most correct. Keep in mind that the closer the SWR approaches 1:1; the more accurate the SWR meter becomes.

Misleading meter readings may be obtained with long transmission lines, since the losses in the cable tend to "smooth out" the standing waves. This condition may give you a much better indication at the transmitter than actually exists at the antenna. Therefore, if you are using a transmission line long enough to have appreciable losses, locate the SWR meter near the antenna, especially when adjusting beams or tuning traps. You can better understand the extent of this effect when you realize that a line with a 3 db loss will show a SWR of 3 when it is terminated in a dead short. A line with a loss of over 10 db will show a SWR of practically 1:1, on this or any other SWR meter, regardless of what load or termination is connected at the far end.

The power losses in these cases occur in the cable, but the SWR meter reading will not indicate that anything is wrong. When in doubt, make measurements at the antenna and at the transmitter, so future changes in the readings will be meaningful. The values of cable losses at various frequencies can be obtained from Figure 3. These losses become worse as time and moisture affect the cable.

With a high SWR, the transmission line losses may become so great that the radiated power is appreciably reduced; with high-power transmitters, the cable ratings may be exceeded. Figure 4 shows the effect of increasing cable losses caused by various values of SWR. When these losses occur, the RF power is turned into heat in the cable instead of being radiated from the antenna.

To figure the total losses in a given length of coaxial cable, determine the db loss per foot of the cable from Figure 3. This is done by finding your operating frequency on the bottom line of the chart, and moving up to find the type of cable used. By looking at this same level on the left-hand side of the chart, you can read the db loss per 100 feet of the cable at that frequency.

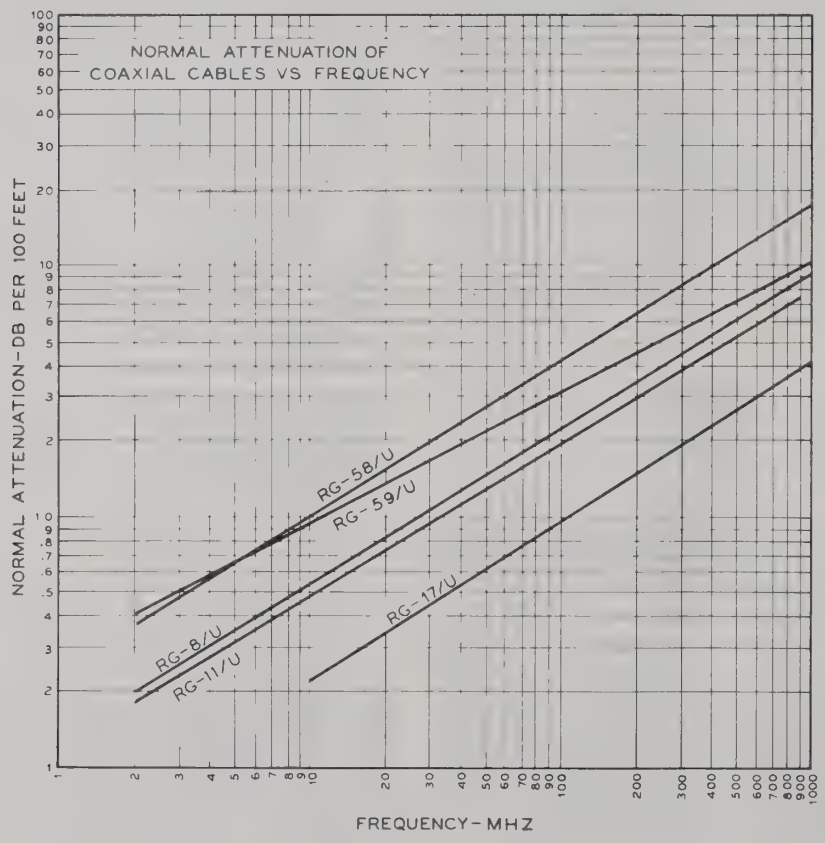


Figure 3

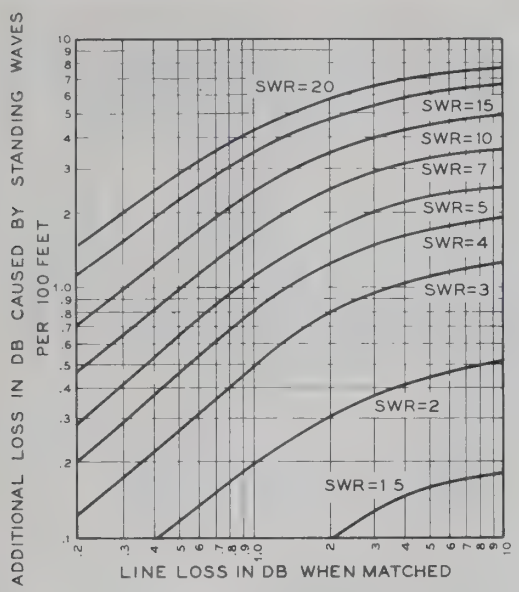


Figure 4

Now determine the additional loss caused by the SWR from Figure 4 as follows: Use the amount of loss determined from Figure 3 and find this value on the bottom line of Figure 4. Now move up the graph until you come to the SWR of your antenna system. Move over to the left-hand side of the graph and determine the amount of loss caused by the SWR. To obtain the total loss of your system, add the value from Figure 3 to the value from Figure 4.

Loading

The load presented to the transmitter output circuit may create conditions that make it touchy or impossible to load the transmitter. With a low SWR, the load that the transmitter "sees" is practically pure resistive. However, at a high SWR, the apparent load may change from a very low to a very high resistance, accompanied by either capacitive or inductive reactance. These resistance and reactance values change when the transmission line length or frequency is changed.

Remember when you are using 50-52 Ω or 70-75 Ω unbalanced feed lines, that the SWR cannot be changed by changing the transmission line length. However, the loading to the transmitter may be changed considerably, thus making it appear that "pruning" the cable length offers improvement, when it actually does not affect the SWR.

The SWR can only be changed by changing the load or termination at the end of the cable. If the transmission line length is changed, for example, with 50 Ω cable and a SWR of 3, the apparent load to the transmitter may vary from 16-2/3 Ω to 150 Ω resistive, with reactance varying from 66-2/3 Ω capacitive, to zero, to 66-2/3 Ω inductive. If the transmitter output tuning adjustments will not accomodate this impedance range, the transmitter will be difficult to load until the load is properly matched to the line. When the load is matched, the SWR will be lower.

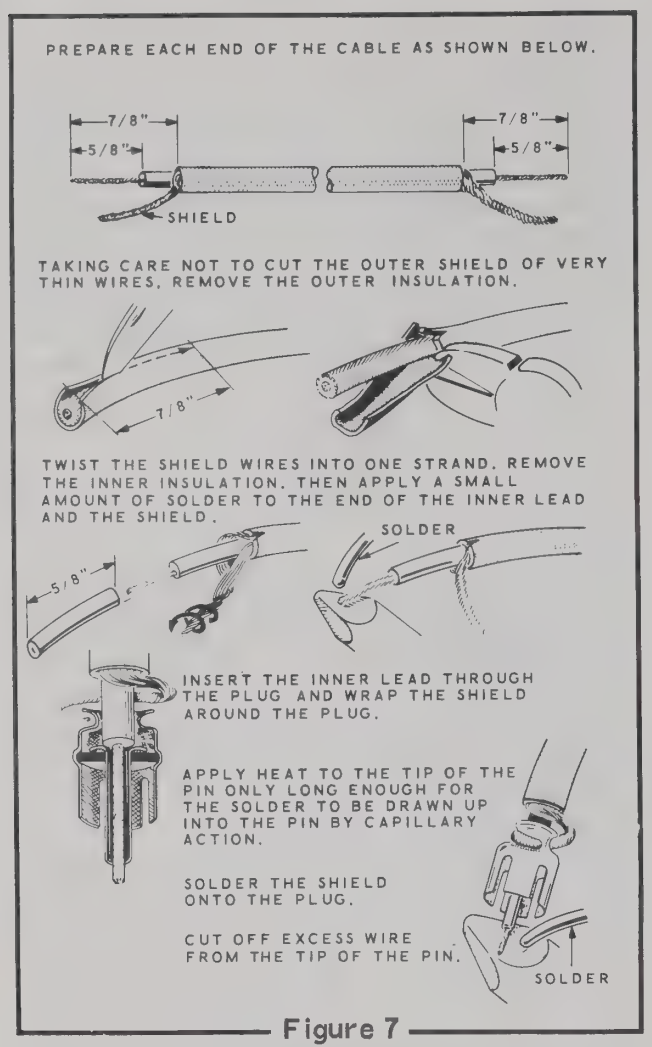

PREPARE EACH END OF THE CABLE AS SHOWN BELOW.
7/8"
5/8"
7/8"
5/8"
SHIELD
TAKING CARE NOT TO CUT THE OUTER SHIELD OF VERY THIN WIRES, REMOVE THE OUTER INSULATION.
7/8"
TWIST THE SHIELD WIRES INTO ONE STRAND. REMOVE THE INNER INSULATION. THEN APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE INNER LEAD AND THE SHIELD.
5/8"
SOLDER
INSERT THE INNER LEAD THROUGH THE PLUG AND WRAP THE SHIELD AROUND THE PLUG.
APPLY HEAT TO THE TIP OF THE PIN ONLY LONG ENOUGH FOR THE SOLDER TO BE DRAWN UP INTO THE PIN BY CAPILLARY ACTION.
SOLDER THE SHIELD ONTO THE PLUG.
CUT OFF EXCESS WIRE FROM THE TIP OF THE PIN.
SOLDER

Figure 7

PHONE PATCH

Installation

HEATH SB SERIES OF EQUIPMENT

To illustrate installation of the Phone Patch a transceiver, a receiver-transmitter combination, and a speaker have been selected from the Heath SB series of amateur equipment. Use the shielded audio cable and the phono plugs supplied to interconnect the equipment as shown in Figure 5 (fold-out from Page 26) and Figure 6 (fold-out from Page 35). Refer to Figure 7 for the installation of phono plugs.

( ) If not previously done, install a phono plug on the end of the lead from your station speaker. Connect this plug to the SPKR socket on the near of the Console.

( ) Connect the SPKR terminal of the transmitter (may be marked "8 Ω" on transceivers) to the RCVR terminal on the back of the Console. Use the shielded cable provided. The shield wires will make the essential ground connection between the pieces of equipment.

( ) Connect the HI-Z phone patch output to the PHONE PATCH input of your transmitting equipment. Use shielded cable.

CAUTION: To prevent the telephone ringing voltage from damaging the VU meter, be sure the ON-OFF switch is turned to OFF before you connect any leads to the telephone line.

( ) Connect one of the two LINE terminals on the back of the Console to the red wire on the telephone terminal block, and the other LINE terminal to the green wire on the terminal block. Polarity is not important. Disregard the yellow wire on the terminal block.

EQUIPMENT OTHER THAN HEATH

Connections to other makes of equipment will vary in details, but the same basic principles will apply. Some notes and suggestions follow:

1. Use shielded wire for all audio interconnecting lines as an aid in the suppression of RF feedback. It is usually unnecessary to use shielded wire between the telephone terminal block and the Phone Patch.

2. If not already provided, arrangements should be made to mute your receiver and to open the SPKR lead when transmitting.

3. If you want to use voice control but no anti-vox output is provided on your receiver, use shielded wire to connect the Anti-Vox transmitter input to the SPKR and GND terminals on the back of the Phone Patch.

4. Usually the HI-Z Phone Patch output will be associated with transmitter grid input circuits and the 600 Ω connection with cathode input circuits. Try both for suitability. Figure 8 shows some suggested microphone and Phone Patch output connections to the first audio stage of your transmitter.

5. If one of the terminals of your speaker is connected to the metal speaker frame, or is grounded in some other manner, connect this terminal to the GND connection on the Phone Patch, and the other speaker terminal to the SPKR connection. If neither speaker terminal is grounded, polarity is unimportant.

6. Make sure that shield wires are properly grounded at both ends to the equipment which they connect and that, if necessary, a separate ground wire interconnects all equipment.

( ) Readjust the Vox and Anti-Vox controls on your transmitting equipment after connecting the Phone Patch.

Null Adjustment

NOTE: Null adjustment is required only when the phone patch is to be used with voice-control operation. If only manual operation is to be used, omit the following steps and proceed to the Operation instructions.

CAUTION: Never try to make the null adjustment without actually placing a phone call. The impedance of a dead line, obtained when dialing only one digit, is different from the line impedance when a completed call is made.

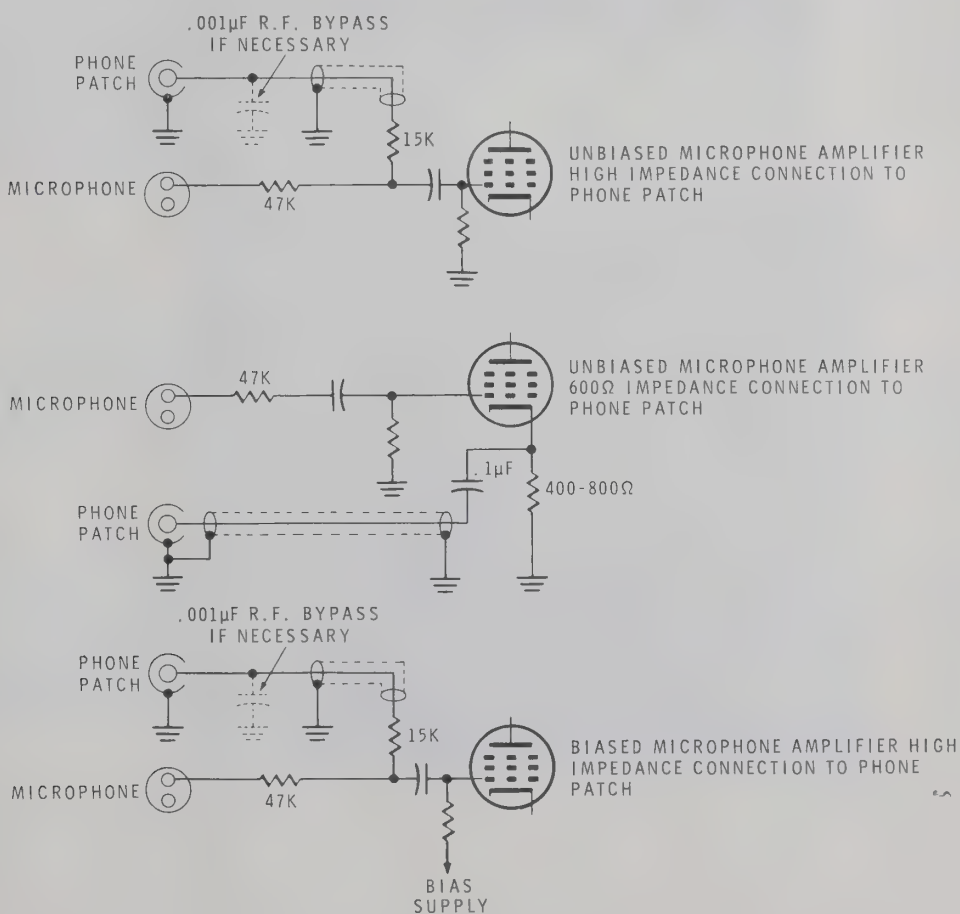


Figure 8

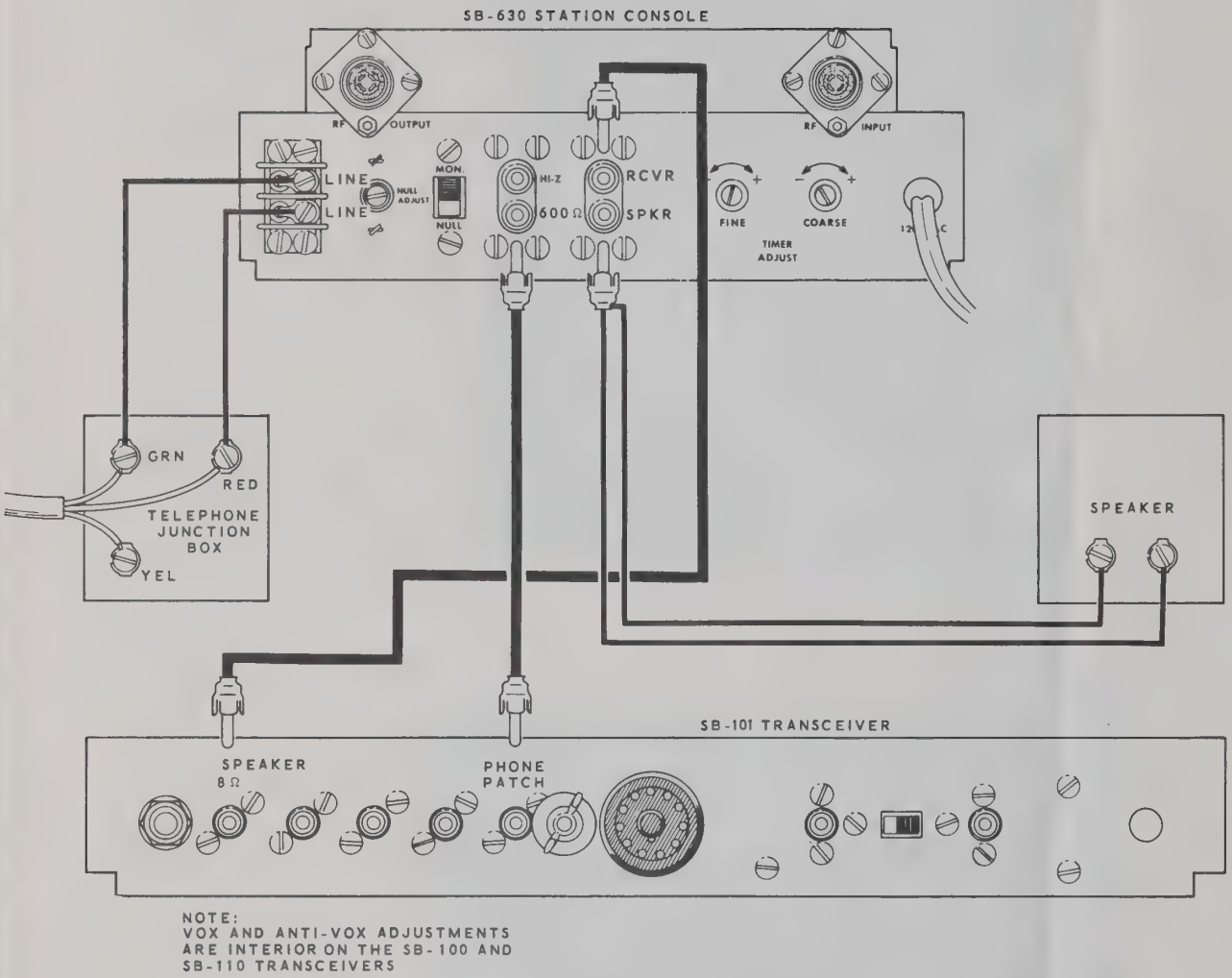

SB-630 STATION CONSOLE
RF OUTPUT
RF INPUT
LINE
LINE
NULL ADJUST
MON.
NULL
HI-Z
600Ω
RCVR
SPKR
FINE
COARSE
TIMER ADJUST
GRN
RED
YEL
TELEPHONE JUNCTION BOX
SPEAKER
SB-101 TRANSCEIVER
SPEAKER 8Ω
PHONE PATCH
NOTE:
VOX AND ANTI-VOX ADJUSTMENTS ARE INTERIOR ON THE SB-100 AND SB-110 TRANSCEIVERS

FIGURE 6

IN CASE OF DIFFICULTY

Since the SB-630 Station Console consists of several independent circuits, a difficulty that might occur in one circuit would not necessarily affect other functions of the Console.

The following General information can be applied to the circuits, or sections, that do not function properly, without checking those circuits that appear to be normal.

1. Recheck the wiring in the faulty section. Have a friend check your work. Someone who is not familiar with the unit may notice something that is overlooked by the builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Soldering section of the Kit Builders Guide.

3. Check the values of the parts. Be sure that the proper parts have been wired into each circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

If your difficulty is in the ten-minute timer circuit, make the following additional checks.

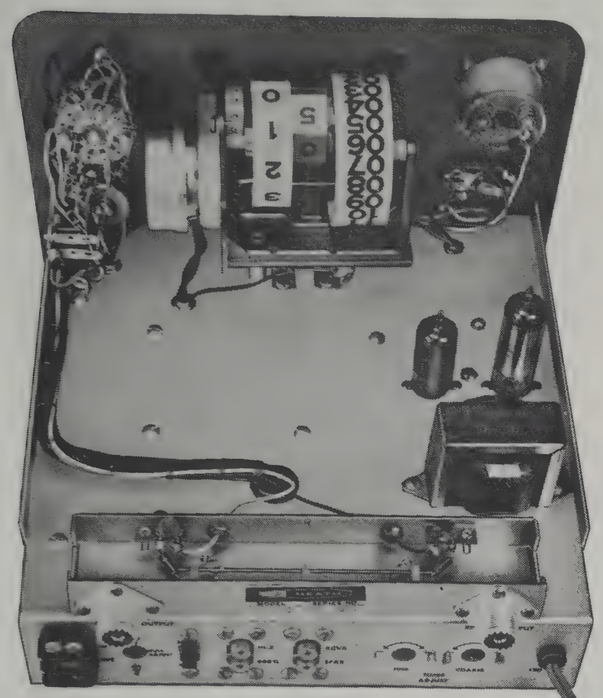
5. Check to be sure that the tubes are in their proper locations. Make sure that tube V1 (6EW6) lights up properly.

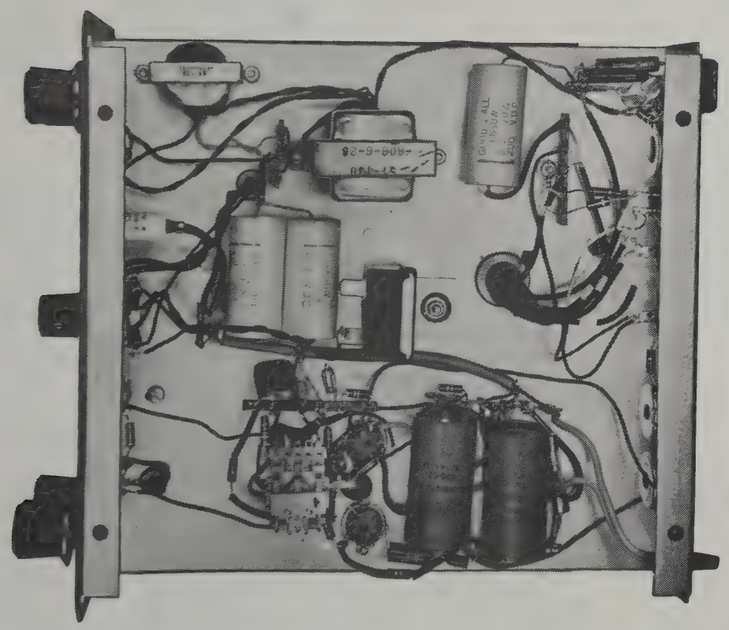
6. Check the tubes with a tube tester, or by substitution of tubes of the same types that are known to be good.

7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. Note: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10%.

Refer to the Kit Builders Guide for service and warranty information.

CHASSIS PHOTOGRAPHS





(✓) Set the Console controls and switches as follows:

NULL-MON switch - NULL.
NULL ADJUST control - Full counterclockwise.
TRANS GAIN control - Full counterclockwise.
RCVR GAIN control - 2/3 clockwise.
MODE switch - SWR METER.

(✓) Tune in a strong heterodyne note of about 800 cps on the receiver. This can be done by beating a crystal calibrator against the receiver BFO.

(✓) Call a friend on the phone. Someone on a different line is best. Explain that there will be a strong tone in the telephone receiver, that he should keep the phone away from his ear, and that he can hang up when the tone stops.

(✓) Leave your telephone handset off the hook, and turn the MODE switch to PHONE PATCH.

(✓) Advance the receiver AF gain control until the VU meter on the Console indicates zero VU.

(✓) Adjust the NULL ADJUST control for a minimum VU meter indication, -20 or less. This dip should occur with about one-half rotation of the NULL ADJUST control.

(✓) Turn the MODE switch to SWR METER and hang up the telephone handset.

(✓) Place the NULL-MON switch in the MON position.

This completes the Null Adjustment of the phone patch.

Operation

The phone patch can be left connected at all times. When the MODE switch is in the SWR METER position, the phone patch is isolated from the telephone line. Use the phone patch in the following manner.

1. Be sure the MODE switch is turned to SWR METER; then dial the desired phone number.

2. When the called party answers, explain the procedure for speaking over a phone patch. Then turn the MODE switch to PHONE PATCH.

NOTE: When the NULL-MON switch is in the MON position, the VU meter indicates the listening level on the telephone lines. The telephone industry permits peaks up to zero VU. In testing the phone patch we have found that this level was much in excess of a comfortable listening level. The exact level will have to be determined by experimentation; however -10 VU seems to be satisfactory in most cases. NEVER PERMIT THE LEVEL TO EXCEED ZERO VU, AS IT MAY CAUSE CROSSTALK BETWEEN TELEPHONE CHANNELS.

3. Adjust the TRANS GAIN control to provide the desired modulation level, and adjust the RCVR GAIN to provide the desired listening level. It is not necessary to change the AF gain controls on the Receiver and Transmitter.

4. It is not necessary to switch the phone patch when changing from transmit to receive. The operator can use the telephone handset for a microphone and headset. When the phone patch call is completed, always turn the MODE switch to SWR METER.

IN CASE OF DIFFICULTY

Since the SB-630 Station Console consists of several independent circuits, a difficulty that might occur in one circuit would not necessarily affect other functions of the Console.

The following General information can be applied to the circuits, or sections, that do not function properly, without checking those circuits that appear to be normal.

1. Recheck the wiring in the faulty section. Have a friend check your work. Someone who is not familiar with the unit may notice something that is overlooked by the builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Soldering section of the Kit Builders Guide.

3. Check the values of the parts. Be sure that the proper parts have been wired into each circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

If your difficulty is in the ten-minute timer circuit, make the following additional checks.

5. Check to be sure that the tubes are in their proper locations. Make sure that tube V1 (6EW6) lights up properly.

6. Check the tubes with a tube tester, or by substitution of tubes of the same types that are known to be good.

7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. Note: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10%.

Refer to the Kit Builders Guide for service and warranty information.

Troubleshooting Chart

This Chart is divided into the following four parts; Clock Circuit, Timer Circuit, SWR Meter Circuit, and phone patch circuit.

CLOCK CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
Clock does not run.	1. Line cord not connected. 2. Fuse blown. 3. Seconds dial drum rubbing against escutcheon window. 4. Faulty wiring of clock leads to AC power circuit.

TIMER CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
Tube V1 (6EW6) filament not lit.	1. Timer switch in OFF position. 2. Filament burned out. 3. Tubes V1 and V2 in wrong sockets. 4. Faulty wiring of filament circuit.
No Identify light when Reset button is pressed; buzzer sounds when Timer switch is in Aural position.	1. #47 pilot lamps burned out. 2. Faulty wiring of pilot lamps or Timer switch circuits. 3. Faulty Timer switch.
Buzzer does not sound when Reset button is pressed if Timer switch is in Aural position.	1. Faulty wiring of buzzer or Timer switch circuits. 2. Faulty Timer switch.
Neither buzzer nor Identify lights operate when Reset button is pressed.	1. Timer switch in Off position. 2. Dirty or faulty relay contacts 5 and 7. 3. Faulty Reset pushbutton switch. 4. Open 33 KΩ resistor R29. 5. Faulty Timer switch or its wiring.
Identify lights and/or buzzer comes on when TIMER switch turned from Off position.	1. Tube V1 (6EW6) shorted. 2. Neon lamp NE2 shorted. 3. Faulty circuit wiring.

DIFFICULTY	POSSIBLE CAUSE
Identify light or buzzer does not signal ten minute interval.	1. Tube V1 (6EW6) weak or dead. 2. Capacitors C21, C22, C23, or C24 faulty. 3. Resistors R22, R24, R25, R26, or R37 open. 4. Faulty diodes D5 or D6. 5. Dirty or faulty relay contacts.

NOTE: Voltage checks in the electronic circuits, when compared with the voltages shown on the Schematic, may help you locate difficulties in the ten-minute timer.

SWR METER CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
No meter reading when transmitting.	1. Mode switch in Phone Patch position. 2. Diode D1 or D2 open. 3. Jumper wire still connected across meter terminals.
Meter deflects backward when transmitting.	1. Diode D1 or D2 installed backward. 2. Meter wires reversed.
Low meter reading when transmitting.	1. SWR Meter switch in REV position. 2. Sensitivity control incorrectly set. 3. Insufficient transmitter power. 4. Resistor R1 or R2 open or wrong value. 5. Capacitor C1 or C2 faulty.

PHONE PATCH CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
No meter reading when receiving.	1. RCVR gain control improperly adjusted. 2. Null-Mon switch in Null position. 3. Diode D3 faulty. 4. Resistor R4 open. 5. RCVR and SPKR plugs transposed.
Poor transmitter gain.	1. Null-Mon switch in Null position. 2. TRANS gain control improperly adjusted. 3. Wrong output impedance used.
Deep null not obtained.	1. Phone dialing not completed. 2. Null Adjust control improperly set.
No transfer of audio between telephone lines and station equipment.	1. Mode switch in SWR Meter position. 2. RCVR and TRANS gain controls improperly adjusted. 3. Resistor R6, R7, R9, or R11 open. 4. Transformers T1 and T2 incorrectly wired.

SPECIFICATIONS

CLOCK

Dial	4-drum, 24-hour, digital readout.
Motor	1 rpm at "seconds" drum; gear driven.
Power Requirements	120 VAC, 60 Hz, 3.7 watts. (Internally connected to Console AC line cord.)

TIMER

Time Interval	Adjustable to 10 minutes.
Time Stability	Less than .2 percent change per hour in normal ambient temperature.
Time Cycle	Instant reset with front panel pushbutton.
Signal	Visual or both visual and aural; switch selected from front panel, with Off position.
Circuit	Resistance-capacitance network. Neon-discharge, vacuum tube relay control.
Tube Complement	6EW6 Relay control. OA2 Voltage regulator.
Power Supply	Transformer operated, voltage regulated, fused.
Power Requirements	120 VAC 60 Hz, 15 watts.

SWR METER

Operation	Indicates percentage of forward and reflected power, and voltage standing wave ratio (SWR).
RF Power Handling Capability	2 kilowatts P.E.P.
Input And Output Impedance	50-52 Ω or 70-75 Ω.
Band Coverage	160 through 6 meters.

PHONE PATCH

Circuit	Telephone hybrid circuit. Allows voice control or manual operation. Single switch places unit in full operation.
Telephone Line Input Impedance	Approximately 600 Ω.
Null Depth	At least 30 db isolation between transmit and receive circuits.
Receiver Impedance	Effective match from 3 to 16 Ω.
Transmitter Impedance	600 Ω or high impedance output.

GENERAL CONSOLE SPECIFICATIONS

Meter	100 Microampere movement. VU readings for phone patch monitoring and null 'epth indication. Relative power and standing wave ratio readings for SWR meter.
Front Panel Controls	Mode: SWR Meter, Phone Patch. Timer: Off, Visual, Audio. Reset: Pushbutton. SWR Meter: Forward, Reverse. SWR Meter: Sensitivity. Phone Patch: Transmitter gain. Phone Patch: Receiver gain.
Rear Panel Controls	Timer Adjust. Null Adjust. Null - Monitor switch.
Dimensions	6-5/8" high x 10" wide x 11-1/8" deep (including knobs).
Net Weight	7-1/2 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 43) while you read this Circuit Description.

The Station Console contains the following independent circuits, which will be described separately: the Clock and Timer Circuit, the SWR Meter Circuit, and the Phone Patch Circuit. A review of the Installation And Operation section of this Manual will also help you understand the function of the circuits.

CLOCK AND TIMER CIRCUIT

The digital readout clock motor is connected to the AC power line through a 3/16 ampere slow-blow fuse. The clock runs continuously when the line cord is connected to a source of 120 V 60 Hz alternating current.

The timer circuit begins to operate when the Timer switch is turned from Off to either Visual or Aural. The neon pilot lamp indicates when the timer is on.

Power for the timer circuit is obtained from transformer T3, through the voltage doubling and filtering network of diodes D4 and D5 and capacitors C26 and C27. Transformer T3 also supplies 6.3 volts AC for the filament of tube V1, for signal buzzer L3, and for the #47 pilot lamps.

Tube V2 is a voltage regulator which keeps the DC supply voltage at a constant level, and resistor R38 is the limiting resistor for the regulator tube.

Resistors R24, R25, and R26 and capacitors C23 and C24 form an RC network with a very slow charging rate. The capacitors charge slowly through the resistors until the potential across the neon discharge lamp is sufficient to cause the lamp to conduct. When the lamp conducts, a positive pulse is sent through capacitor C22 to the grid of V1. The potential across the neon discharge lamp is governed by the setting of the Timer Adjust controls, which are in the voltage divider circuit of R34, R35, R36, and R37, and series resistor R33.

The positive pulse that is applied to the grid of V1 causes the tube to conduct and pass current through resistor R31 and the coil of the relay. With the relay coil energized, contacts 5 and 7 close to apply 6.3 VAC to the #47 pilot lamps (and to buzzer L3).

When relay contacts 1 and 9 close, capacitor C25 discharges through resistors R32 and R27 to hold the grid positive (and hold the relay closed) for approximately one second. The values of resistors R27 and R32, in series with capacitor C25, determine the length of time required for C25 to discharge. Thus, a higher resistance for R27 would increase the time that the relay would remain closed and the identify window lit. Contacts 2 and 9 of the relay had caused capacitor C25 to charge from the power supply before the relay closed.

While the relay coil is energized, contacts 3 and 8 close to discharge capacitors C23 and C24 through resistor R28; then the timing cycle begins again.

When the Reset button is pressed, current flows from the power supply, through the relay coil, the Reset button contacts, and resistor R29 to ground. This energizes the relay coil to close the relay contacts and restarts the timing cycle.

SWR METER CIRCUIT

The SWR Meter circuit is based upon the circuit of a device developed at the U.S. Naval Research Laboratory, Washington, D.C., and described in N.R.L. report No. 3538, titled "A Reflectometer for H-F Band." Simplified versions have also been described in various amateur radio publications.

The SWR meter consists of a short section of transmission line to which two small linear inductors are coupled, both inductively and capacitively. The radio frequency current flowing in each inductor and its load resistor is rectified by a germanium diode and filtered by a ceramic capacitor. Because L1 is terminated at the output and L2 is terminated at the input, the rectified current in L1 indicates forward relative power, while the rectified current in L2 indicates reverse relative power. The SWR Meter switch selects the direct current output of either diode and applies it to a variable-sensitivity metering circuit, consisting of a linear potentiometer and a microammeter.

The Mode switch connects the meter to the output of the sensitivity control in the SWR Meter position, and the meter indicates reflected power, or SWR. In the other position, the Mode switch is connected to the Phone Patch circuit which will be described next.

PHONE PATCH CIRCUIT

The phone patch circuit is based on the use of special hybrid transformer T1. The hybrid transformer with proper adjustment of the Null-Adjust control, will provide a high degree of isolation between the receiving and transmitting circuits. This feature is required for stable voice-control operation.

The operation of a hybrid transformer is shown in Figures 9 and 10. Refer to the Schematic Diagram (fold-out from Page 43) while reading this Description.

Figure 9 shows the phone patch in the Transmit cycle; that is, energy from the telephone line is being routed to the transmitter. The turns ratio of the hybrid transformer is such that the impedance of windings C, D, and Z_T are equal. If voltage E (representing an incoming voltage of the telephone line) is impressed on the transformer, it will at a given instant, cause current to flow as shown by the arrows. The opposing voltage drop across winding C will equal that across winding Z_T. Identical winding D is linked by the same flux as winding C; therefore it will have an induced (opposing) voltage of equal magnitude and in the same direction as winding C. The induced voltage in winding D is equal to the voltage across winding Z_T, and since their like polarities are connected together, no current flow will occur through Z_B. The result is that one-half of the incoming energy is available at the transmitter input and the other half is dissipated across Z_R.

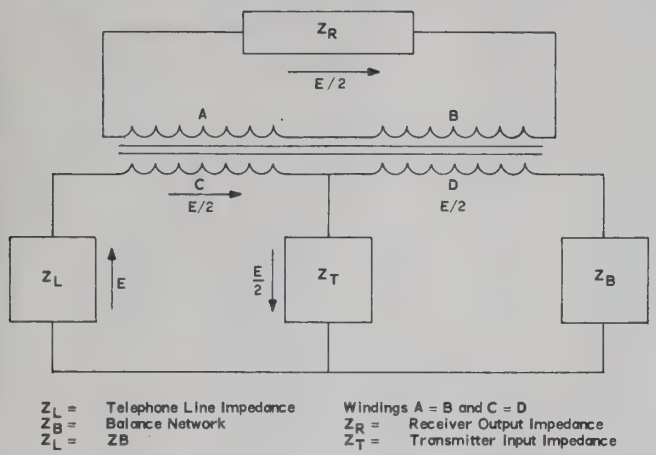


Figure 9

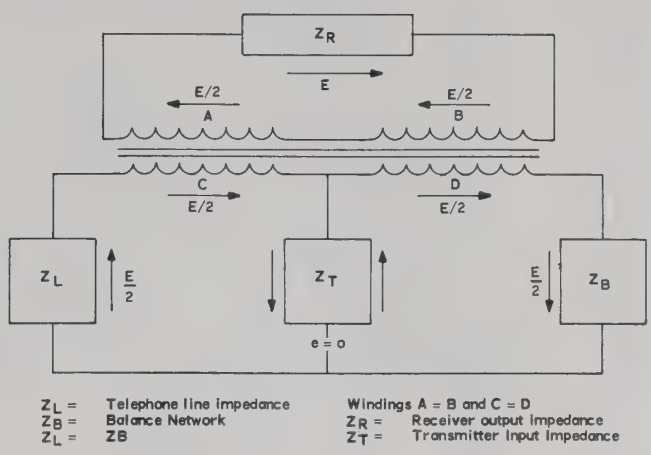


Figure 10

In Figure 10, the phone patch is shown in the receive cycle, with the signal from the receiver routed to the telephone line. If voltage E (representing a voltage from the receiver) is impressed on the transformer, it will, at a given instant, cause current to flow as shown by the arrows. Windings A and B are connected in series aiding.

Equal voltages are induced in each winding, since winding C equals winding D. The balance network is adjusted so that Z_B equals Z_L, therefore the voltage drops across Z_B and Z_L are equal. This will cause equal and opposite currents through Z_T, so there is no voltage across Z_T and no energy is fed to the transmitter input.

The turns ratio of the transformer windings (T1 and T2) match the speaker and transmitter input impedances to the hybrid windings of transformer T1.

The phone patch circuit, and the meter, are coupled to the telephone line when the Mode switch (S3) is turned to the PHONE Patch position. The meter, coupled through resistors R4 and R5 and diode D3, closely approximates standard VU readings. A zero VU reading represents 4 db above 1 milliwatt in 600 Ω, and is the maximum voltage allowed on the telephone lines to avoid crosstalk between channels.

A Null-Monitor switch, S2, is provided on the rear apron so the VU meter can be used as a null indicator when the balance network is adjusted. In the Null position of S2, resistor R5 is switched out of the circuit to increase the sensitivity of the meter.

The telephone line connections to the phone patch are filtered by a balanced pi network to prevent RF from entering the phone lines and/or the transmitter audio circuits.

Since the impedance of telephone lines vary greatly from installation to installation, it is necessary to isolate the line impedance so a simple balance network will provide a sufficient null at every installation. This is accomplished by connecting the telephone line to the phone patch through an H pad. This H pad, which is formed by resistors R6, R7, R8, R9, and R11, has an impedance of 600 Ω. The pad forces the line impedance to appear as approximately a 600 Ω resistance. This allows the impedance of Null Adjust control R14 with resistor R13 to equal the line impedance and provide a deep null.

In order to provide a balanced load to the telephone line, an important feature in minimizing hum, the hybrid transformer incorporates additional windings, and the resistive pad is made in the "H" form.

The telephone line is also connected to the phone patch through capacitor C7. This capacitor blocks the DC voltage of the telephone line but allows the audio frequencies to pass. The large value of capacitance has very little reactance at audio frequencies, thus allowing the phone patch to maintain good audio quality.

Resistors R24, R25, and R26 and capacitors C23 and C24 form an RC network with a very slow charging rate. The capacitors charge slowly through the resistors until the potential across the neon discharge lamp is sufficient to cause the lamp to conduct. When the lamp conducts, a positive pulse is sent through capacitor C22 to the grid of V1. The potential across the neon discharge lamp is governed by the setting of the Timer Adjust controls, which are in the voltage divider circuit of R34, R35, R36, and R37, and series resistor R33.

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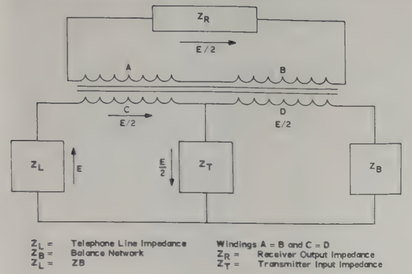

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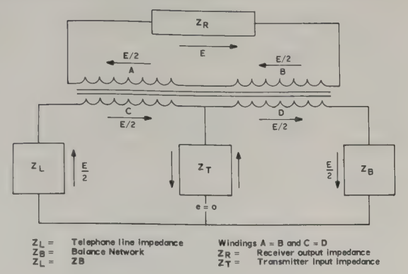

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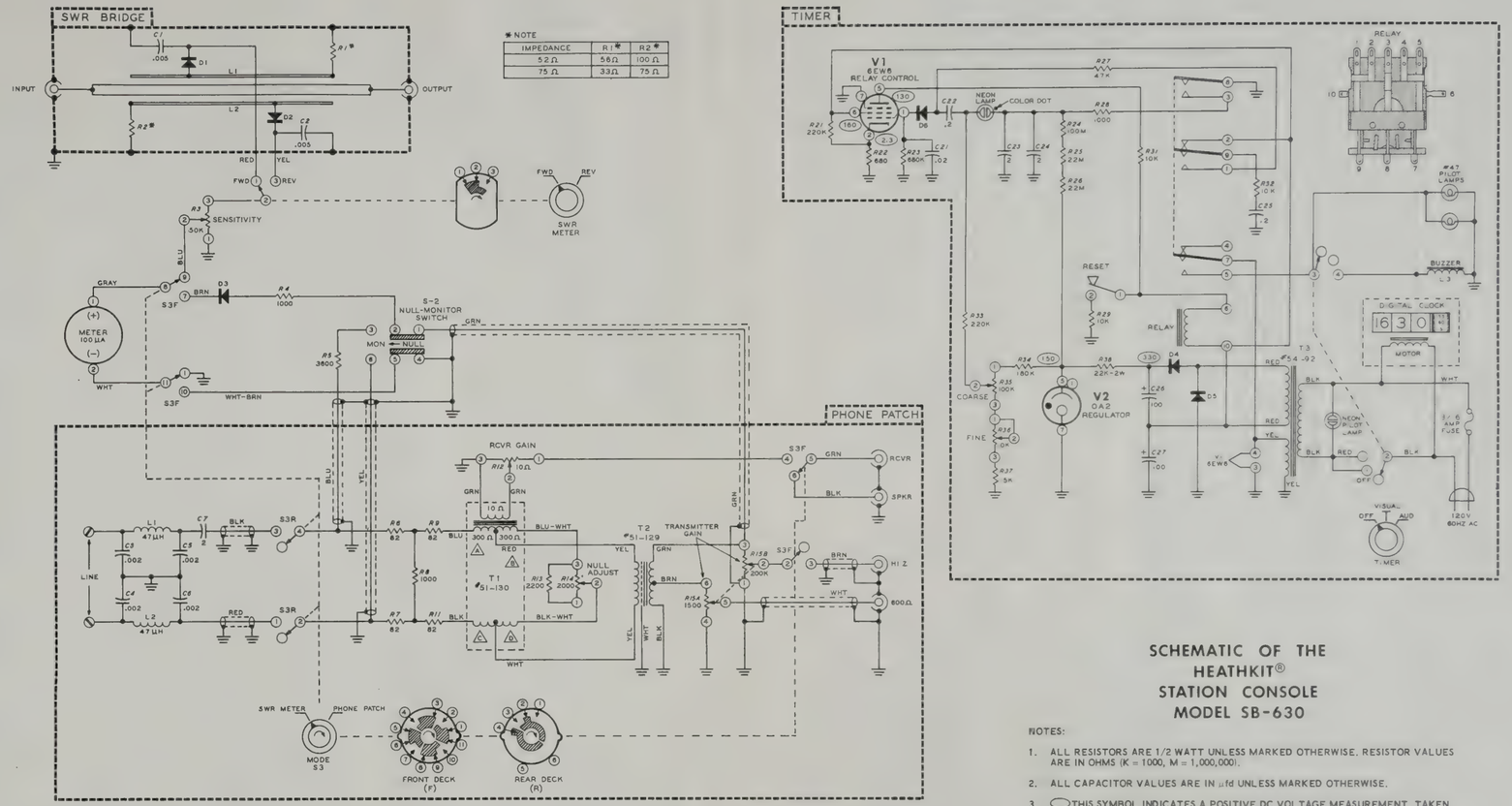

SCHEMATIC OF THE HEATHKIT® STATION CONSOLE MODEL SB-630

NOTES:

1. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K = 1000, M = 1,000,000).
2. ALL CAPACITOR VALUES ARE IN µfd UNLESS MARKED OTHERWISE.
3. ⊖ THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT, TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±10%.
4. ALL SWITCH WAFERS SHOWN IN FULL COUNTERCLOCKWISE POSITION, AS VIEWED FROM THE KNOB END OF THE SHAFT.

REPLACEMENT PARTS PRICE LIST

PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1/2 Watt		
1-103	.10	33 Ω
1-83	.15	56 Ω
1-146	.10	75 Ω
1-118	.10	82 Ω
1-123	.10	100 Ω
1-7	.10	680 Ω
1-9	.10	1000 Ω
1-44	.10	2200 Ω
1-82	.10	3600 Ω
1-20	.10	10 KΩ
1-21	.10	15 KΩ
1-25	.10	47 KΩ
1-126	.10	180 KΩ
1-29	.10	220 KΩ
1-34	.10	680 KΩ
1-70	.10	22 megohm
1-139	.10	100 megohm
2 Watt		
1-11-2	.20	22 KΩ
CAPACITORS		
21-36	.10	.002 μfd disc
21-27	.10	.005 μfd disc
21-31	.10	.02 μfd disc
27-34	.25	.2 μfd resin
27-21	1.15	2 μfd tubular
25-57	.95	100 μfd electrolytic
CONTROLS		
11-64	1.35	10 Ω wire-wound
10-11	.50	50 KΩ
10-52	.40	2000 Ω tab-mount
10-57	.35	10 KΩ tab-mount
10-58	.35	100 KΩ tab-mount
12-68	1.45	1500 Ω and 200 KΩ dual
SWITCHES		
60-2	.25	DPDT slide
64-7	.90	SPST pushbutton
63-177	.85	2-position rotary
63-189	1.85	3-position rotary
63-428	2.95	2-section rotary

PART No.	PRICE Each	DESCRIPTION
COILS-CHOKE-TRANSFORMERS		
40-98	.55	RF driver element
40-99	.10	RF pickup element
45-2	.25	47 μH RF choke
51-129	3.05	Input transformer
51-130	4.95	Hybrid line transformer
54-92	2.80	Power transformer
DIODES-TUBES-LAMPS-FUSE		
56-26	.30	1N191 germanium diode
57-27	.60	Silicon diode
411-59	1.35	OA 2 tube
411-170	1.20	6EW6 tube
412-10	.85	Snap-in neon lamp
412-34	.55	Neon lamp
412-20	.20	#47 pilot lamp
421-40	.40	3/16 ampere slow-blow fuse
TERMINAL STRIPS		
431-16	.10	2-lug
431-28	.10	2-lug vertical
431-70	.30	2-lug screw-type
431-62	.10	3-lug miniature
431-10	.10	3-lug
431-11	.10	5-lug
431-45	.10	6-lug
SOCKETS-CONNECTORS-PLUGS		
434-34	.15	Tube socket
434-82	.10	Double phono socket
434-88	.15	Pilot lamp socket
436-5	.85	Coaxial connector
438-4	.10	Phono plug
HARDWARE		
Screws		
250-49	.05	3-48 x 1/4"
250-2	.05	4-40 x 3/16"
250-56	.05	6-32 x 1/4"
250-162	.05	6-32 x 1/2"
250-143	.05	6-32 x 1/2" stud
250-29	.05	6-32 x 3/4"
250-40	.05	6-32 x 1-1/2"
250-8	.05	#6 x 3/8" sheet metal
250-93	.05	8-32 x 1/4" setscrew

PART No.	PRICE Each	DESCRIPTION
Nuts		
252-1	.05	3-48
252-3	.05	6-32
252-7	.05	Control nut
252-10	.05	Speednut
Washers		
254-7	.05	#3 lockwasher
254-9	.05	#4 lockwasher
254-1	.05	#6 lockwasher
253-60	.05	Thin #6 flat washer
253-27	.05	Thick #6 flat washer
253-1	.05	#6 fiber washer
254-5	.05	Control lockwasher
253-10	.05	Control flat washer
Other Hardware		
259-1	.05	#6 solder lug
259-10	.05	Control solder lug
255-21	.20	7/8" tapped spacer
WIRE-CABLE-HARNESS-SLEEVING		
89-1	.35	Line cord
344-50	.05/ft	Hookup wire
347-9	.10/ft	3-wire shielded cable
134-141	4.65	Harness
346-1	.05/ft	Sleeving
SHEET METAL PARTS		
90-337	8.70	Cabinet shell
200-477-1	2.75	Chassis
203-458-1	.85	Front panel
206-325	.35	SWR bridge base
206-326	.25	SWR bridge cover

PART No.	PRICE Each	DESCRIPTION
PLASTIC AND RUBBER PARTS		
100-603	1.80	Escutcheon
73-4	.10	5/16" rubber grommet
73-46	.10	5/16" plastic grommet
73-43	.10	3/8" plastic grommet
73-44	.10	3/4" plastic grommet
75-24	.10	Line cord strain relief
255-12	.10	Plastic spacer
261-9	.05	Rubber foot
261-25	.05	Plastic foot
255-59	.15	Foot spacer
MISCELLANEOUS		
69-34	5.00	DPDT relay
69-42	1.50	Buzzer
406-49	20.00	Clock movement
407-114	9.50	Meter
462-159	.30	Small knob
462-191	.70	Skirted knob
391-48	1.20	Heathkit nameplate
490-5	.10	Nut starter
490-6	.10	#8 allen wrench
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from an authorized Service Center or Heathkit Electronic Center to cover local sales tax, postage and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.

HEATH COMPANY

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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HEATHKIT®
ASSEMBLY MANUAL

STATION CONSOLE
MODEL SB-630

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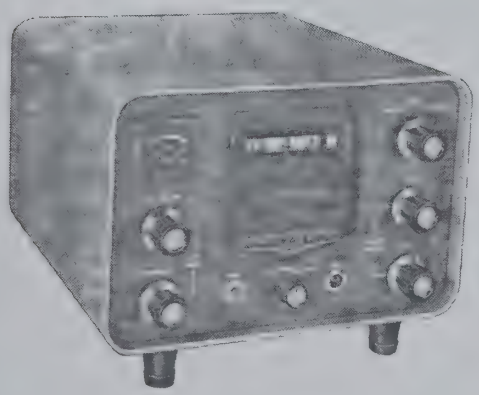
Assembly
and
Operation
of the

HEATHKIT

STATION CONSOLE

Model SB-630



HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

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INTRODUCTION

The Heathkit Model SB-630 Station Console is a multipurpose instrument that includes an SWR (standing wave ratio) meter, a hybrid phone patch, a ten-minute timer, and an accurate digital readout clock. The Console was designed for use with an amateur radio station, or with other types of transmitters or transceivers.

The SWR meter section of the Console indicates the power transfer efficiency between a transmitter and antenna. If it is used with a transceiver, it will not affect receiver operation. The combination of very low insertion loss and high power rating permits the SWR meter to remain permanently inserted in a 50-52 Ω or 70-75 Ω transmission line. This permits constant monitoring of reflected power or SWR to determine proper transmitter tuning, transmission line-to-antenna impedance matching and relative power output.

The SWR meter section can also be used for other applications, such as testing the design of antenna coupling networks, checking other transmission systems, etc. The input and output connectors are standard SO-239 coaxial connectors.

The hybrid phone patch section of the Console is used to transfer audio signals between telephone lines and two-way radio equipment. It can be used either manually or with voice-control-operated (VOX) transmitters, without changing any connections.

When the phone patch section of the Console is used, the meter will indicate the VU level so you can monitor the phone patch output. This assures you that you are supplying the proper volume level to the telephone line so cross-talk is prevented. The meter also permits you to make a convenient null adjustment check (maximum null depth produces maximum isolation between the telephone line and station equipment, resulting in the best operating conditions for voice-control circuits). Proper match to the telephone line, with minimum hum, is provided by a specially designed hybrid transformer.

The ten-minute timer in the Console reminds you to give your call letters and identify your station at ten minute intervals, to comply with FCC (Federal Communications Commission) regulations. Either a visual reminder, or both visual and aural reminders, can be selected by a switch on the Console front panel. The timer can be reset at any time to start a new ten minute interval.

The electric clock has a digital readout dial which shows the hour, minute, and second. The clock is independent of all other circuits in the Console, and runs whenever the power cord is connected to the AC line.

The SWR meter and the hybrid phone patch require no AC power for operation. They can be used with the timer switch turned off or with the line cord disconnected. AC power is required for operation of the ten-minute timer and for the electric clock.

The styling of the Model SB-630 Station Console matches that of other Heathkit SB-series equipment, and its versatility makes it a useful instrument for any amateur or other radio station.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

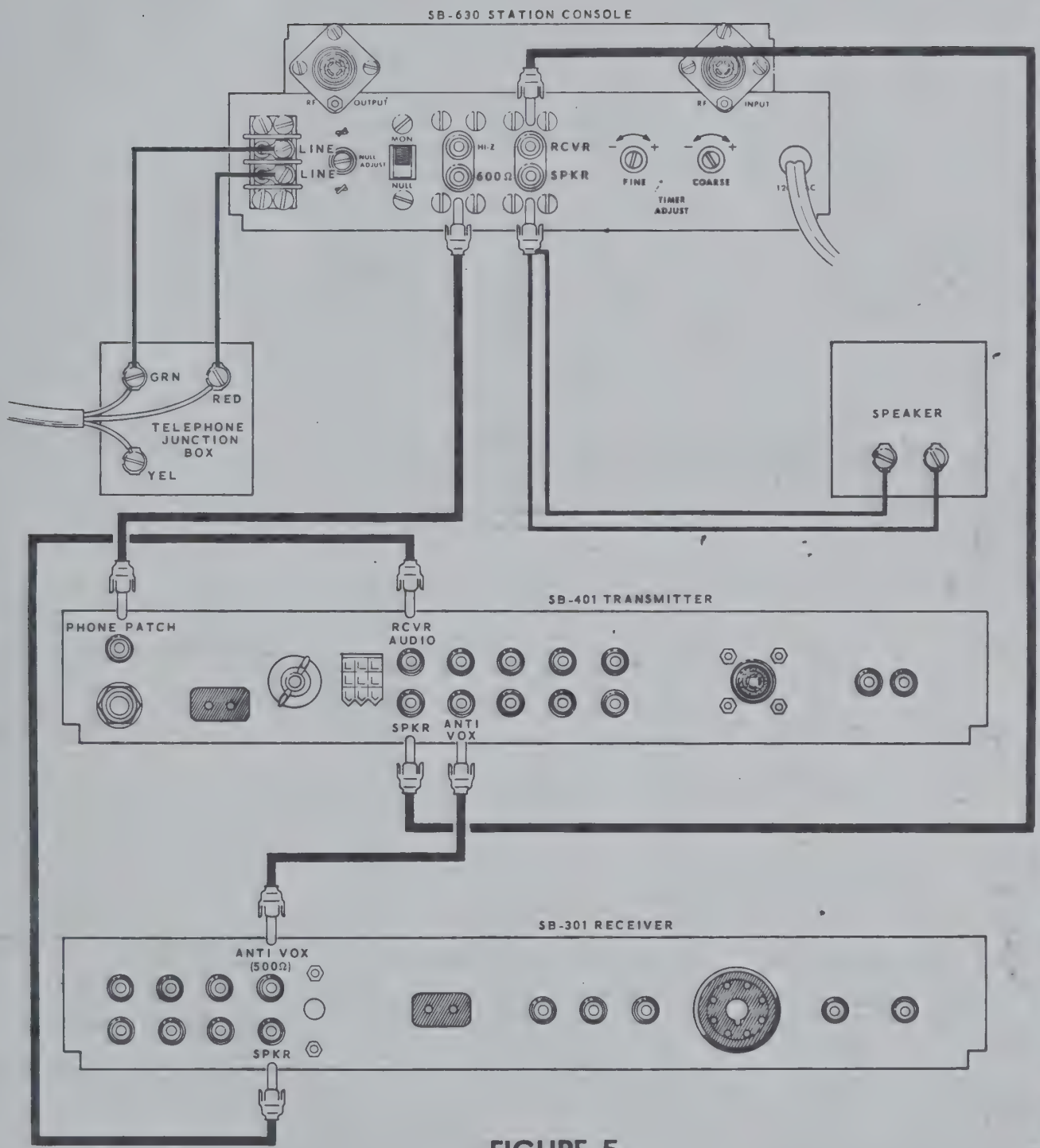

SB-630 STATION CONSOLE
RF OUTPUT
RF INPUT
LINE
LINE
NULL ADJUST
MON
NULL
HI-Z
600Ω
RCVR
SPKR
FINE
COARSE
TIMER ADJUST
GRN
RED
YEL
TELEPHONE JUNCTION BOX
SPEAKER
SB-401 TRANSMITTER
PHONE PATCH
RCVR AUDIO
SPKR
ANTI VOX
SB-301 RECEIVER
ANTI VOX (500Ω)
SPKR

FIGURE 5

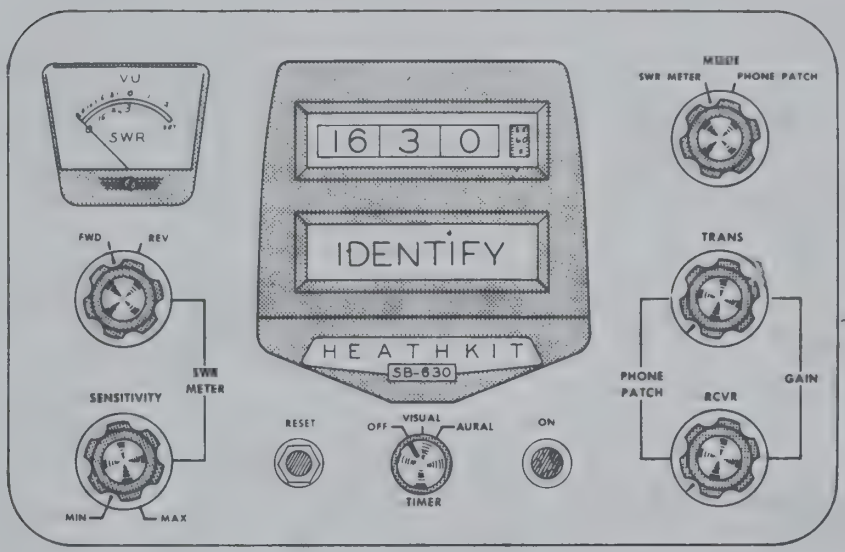


FIGURE 1

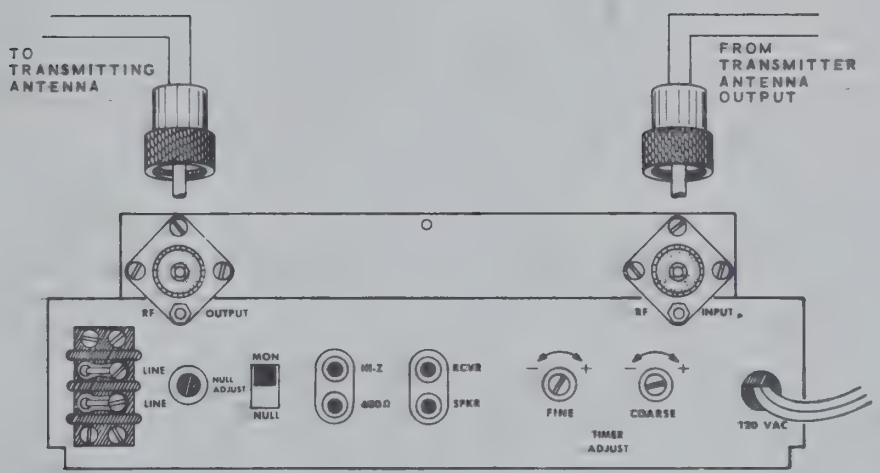
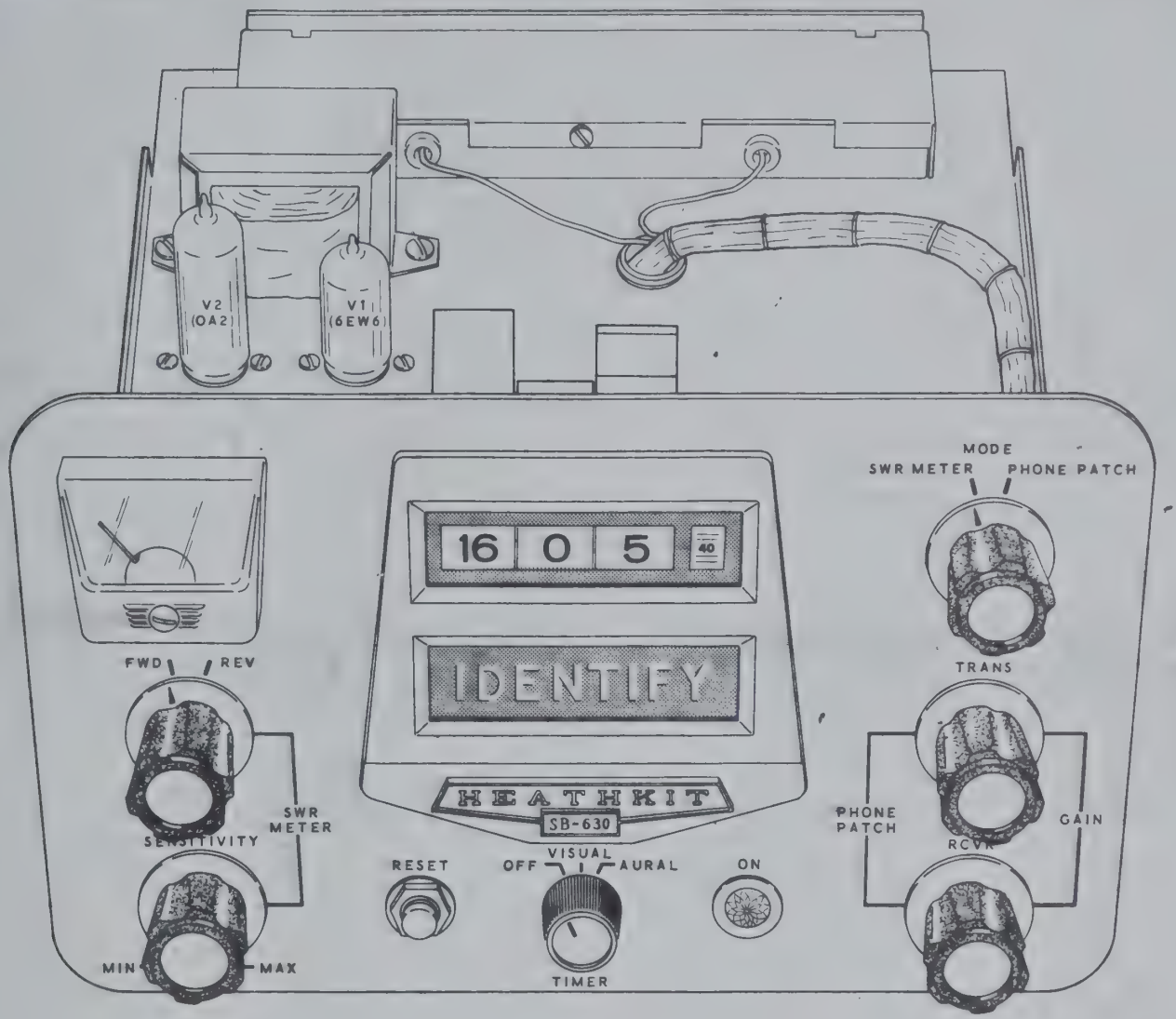


FIGURE 2



PICTORIAL 11

INITIAL TEST

Before you connect the line cord to the AC outlet, be sure all front panel controls and switches are in their full counterclockwise position. Refer to Figure 1 (fold-out from Page 26). Should the desired results not be obtained in any of the following tests, unplug the line cord at once and refer to the In Case Of Difficulty section on Page 37.

NOTE: This Manual uses the new IEEE (Insti-. tue of Electrical and Electronic Engineers) and international standard term "hertz" as the basic unit of frequency. The terms are used as follows:

Hz (hertz) = cps (cycles per second).
kHz (kilohertz) = kc (kilocycles per second).
MHz (megahertz) = mc (megacycles per second).

( ) Connect the line cord to a 120 V AC 60 Hz outlet. The clock should run, but the tubes and the ON pilot lamp should not light.

( ) Turn the TIMER switch to VISUAL. The ON pilot lamp should light and begin to warm up.

( ) After about 30 seconds, press the RESET button. The IDENTIFY window should light.

( ) Turn the TIMER switch to AURAL and press the RESET button. Now the buzzer should sound and the IDENTIFY window should light.

( ) Set both TIMER ADJUST controls to the center of their rotation. These controls are located on the rear of the chassis.

( ) Momentarily press and release the RESET button and note the time. After approxi-mately ten minutes, the buzzer should sound and the IDENTIFY window should light for one second.

This completes the Initial Tests of the timer circuits. The reflected power and SWR meter, and the phone patch sections of the Console will be tested in actual operation. If you wish to test these sections with your station equip-ment before you install the Console in its cabi-net, turn to the Installation and Operation sec-tion on Page 30. Then, return to the Final Assembly instructions.

FINAL ASSEMBLY

Refer to Pictorial 12 for the following steps.

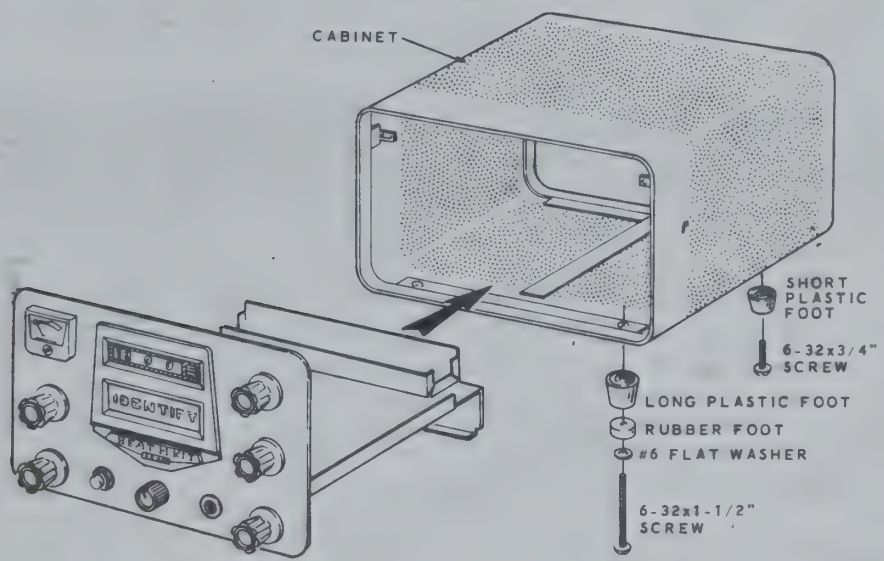
Two sizes of plastic feet and four rubber feet are supplied so the Console can be set level, or tilted upward or downward. Pictorial 12 shows the feet and hardware used for a typical installation, and provides a tilt to match other Heathkit SB series equipment.

( ) Choose the type of feet needed to support the Console at the angle you prefer.

( ) Slide the Console into the cabinet.

( ) Fasten the Console in the cabinet with the foot mounting screws and appropriate feet (and washers if used). Use 6-32 x 3/4" screws and #6 flat washers with the rubber feet, and 6-32 x 3/4" screws with the short plastic feet. Use 6-32 x 1-1/2" screws with the long plastic feet.

Save the two extra screws and any feet or washers not used. You may want to change the tilt of your Console later.



PICTORIAL 12

INSTALLATION AND OPERATION

The digital electric clock, the ten-minute timer, the SWR meter, and the phone patch, are independent sections within the Station Console. The installation and operation of each of these sections will be presented separately. Figure 1 (fold-out from Page 26) shows the location of front panel controls and switches. Figure 2 shows the connectors, jacks, controls, and switch located on the rear of the chassis.

DIGITAL ELECTRIC CLOCK

Installation

No special installation of the clock is required, since it runs whenever the line cord is connected to a 120 volt 60 Hz AC power line.

Operation

To set the clock, rotate the numbered minute and hour drums until the correct time appears in the window of the escutcheon. Do not move the drums when the seconds indicator is near 60. If you desire to set the seconds drum to an accurate time standard (National Bureau of Standards station WWV, for example), disconnect the line cord from the AC power line and wait for the time standard seconds to match the seconds indicated on the clock. Then plug in the line cord and set the minute and hour drums as before.

TEN-MINUTE TIMER

Installation

Connect the line cord to a 120 volt 60 Hz AC power line. The ten-minute timer requires no other installation.

Operation

Turn the TIMER switch to either VISUAL or AURAL. The neon pilot lamp will indicate that the timer is on. Press the RESET button. After a time interval of approximately ten minutes, slowly turn the Coarse control until the IDENTIFY window in the escutcheon lights. The IDENTIFY window will light and the buzzer will sound when the TIMER switch is in the AURAL position.

NOTE: The timer measures an interval that begins when the RESET button is pressed, or when the TIMER switch is turned from Off to either VISUAL or AURAL. To increase the timing interval, turn the TIMER ADJUST controls clockwise. To decrease the interval, turn the controls counterclockwise. The Coarse control permits you to adjust the time interval to within a minute, and the Fine control allows adjustment to within seconds of the desired interval.

The timed interval repeats automatically after the IDENTIFY window lights or the buzzer sounds. The time interval will restart at any time during the cycle if the RESET button is pressed.

When the timer is used with an amateur station, it is a good practice to press the RESET button at the beginning of a transmission. The IDENTIFY light or the buzzer will remind the operator to give his station identification, or call letters, every ten minutes.

The TIMER switch can be left in the OFF position when the timer is not in use, since the ten-minute timer has no effect on the SWR meter or phone patch sections of the Console.

SWR METER

Installation

The SWR meter section of the Console connects between the transmitter output and the antenna transmission line with standard coaxial connectors. The meter can be used with either 50-52 Ω or 70-75 Ω transmission lines, depending on the values of resistors R1 and R2 that were installed in the SWR bridge during assembly. The meter will not perform properly in transmission lines of other impedance, or with lines that are used as tuned feeders. No AC power is needed to operate the SWR meter.

( ) Cut the coaxial transmission line at a place that will allow the Console to set at a convenient location. Install male coaxial connectors on the cable ends.

( ) Connect the transmitter output cable to the RF Input connector and connect the antenna cable to the RF Output connector on the rear of the Console. See Figure 2.

NOTE: If an antenna tuner is used, connect the SWR meter between the transmitter and the antenna tuner with coaxial cable of proper impedance. Then the tuner can be adjusted for maximum output and minimum standing wave ratio.

Operation

Before you apply power to the transmitter, turn the MODE switch to SWR METER, the SWR METER switch to FWD, and the SENSITIVITY control to MIN.

1. Turn on the transmitter and tune it. Disregard any SWR Meter readings during transmitter tuning.

2. After the transmitter is tuned, and with power still applied, set the SENSITIVITY control for a midscale reading on the SWR meter.

NOTE: You may wish, at this time, to "touch up" the tuning of the transmitter. If this "touch up" increases your output, as shown by an increase in the SWR meter reading, you will have obtained a closer match between the transmitter and the transmission line.

3. Set the SENSITIVITY control to give a full-scale (SET) meter reading.

4. Turn the SWR METER switch to REV. The standing wave ratio (SWR) can now be read directly on the meter.

NOTE: The SWR meter can be switched between FWD and REV during transmission and no switching transient will result, since the switch is connected in a low-power bridge circuit. The SWR meter may be left connected in the transmission line at all times for continuous monitoring purposes.

Normal Operating Characteristics

The minimum transmitter output power that is needed to operate the SWR meter varies with frequency. 70 watts are needed for full-scale deflection on 75 meters with the SWR METER switch in the FWD position, while only 2 or 3 watts are required for full-scale deflection on 6 meters. At low power levels where full-scale deflection cannot be obtained, the reflected power indicated with the switch in the REV position will be approximately proportional to the ratio between the actual and full-scale FWD meter readings. For example, if the transmitter output power will only drive the meter to 70% of full scale, then the SWR that you read on the meter in the REV position will only be 70% of the actual SWR in your transmission line.

As the transmitter is voice modulated, the meter will deflect downward slightly. This will occur when the SWR METER switch is in the FWD position; it should not be confused with downward modulation. This effect is generally due to a nonlinear relationship between the voltage and current in the final amplifier of the transmitter, and should not alarm the operator since it is entirely normal with high level modulation.

Control carrier modulation will "kick" the meter indication upward on peaks. SSB and DSB signals will give a bouncing indication when transmitting, so no SWR measurement can be made. Therefore, use a single-tone or CW carrier with sideband transmitters when taking readings. When operating SSB, any meter indication with no modulation indicates spurious or parasitic emission, or poor carrier suppression.

Physical Placement and Losses

The meter readings may vary if the SWR meter is placed at different locations in the transmission line, or if the length of the transmission line is changed. For this reason, assume that the highest SWR reading is most correct. Keep in mind that the closer the SWR approaches 1:1; the more accurate the SWR meter becomes.

Misleading meter readings may be obtained with long transmission lines, since the losses in the cable tend to "smooth out" the standing waves. This condition may give you a much better indication at the transmitter than actually exists at the antenna. Therefore, if you are using a transmission line long enough to have appreciable losses, locate the SWR meter near the antenna, especially when adjusting beams or tuning traps. You can better understand the extent of this effect when you realize that a line with a 3 db loss will show a SWR of 3 when it is terminated in a dead short. A line with a loss of over 10 db will show a SWR of practically 1:1, on this or any other SWR meter, regardless of what load or termination is connected at the far end.

The power losses in these cases occur in the cable, but the SWR meter reading will not indicate that anything is wrong. When in doubt, make measurements at the antenna and at the transmitter, so future changes in the readings will be meaningful. The values of cable losses at various frequencies can be obtained from Figure 3. These losses become worse as time and moisture affect the cable.

With a high SWR, the transmission line losses may become so great that the radiated power is appreciably reduced; with high-power transmitters, the cable ratings may be exceeded. Figure 4 shows the effect of increasing cable losses caused by various values of SWR. When these losses occur, the RF power is turned into heat in the cable instead of being radiated from the antenna.

To figure the total losses in a given length of coaxial cable, determine the db loss per foot of the cable from Figure 3. This is done by finding your operating frequency on the bottom line of the chart, and moving up to find the type of cable used. By looking at this same level on the left-hand side of the chart, you can read the db loss per 100 feet of the cable at that frequency.

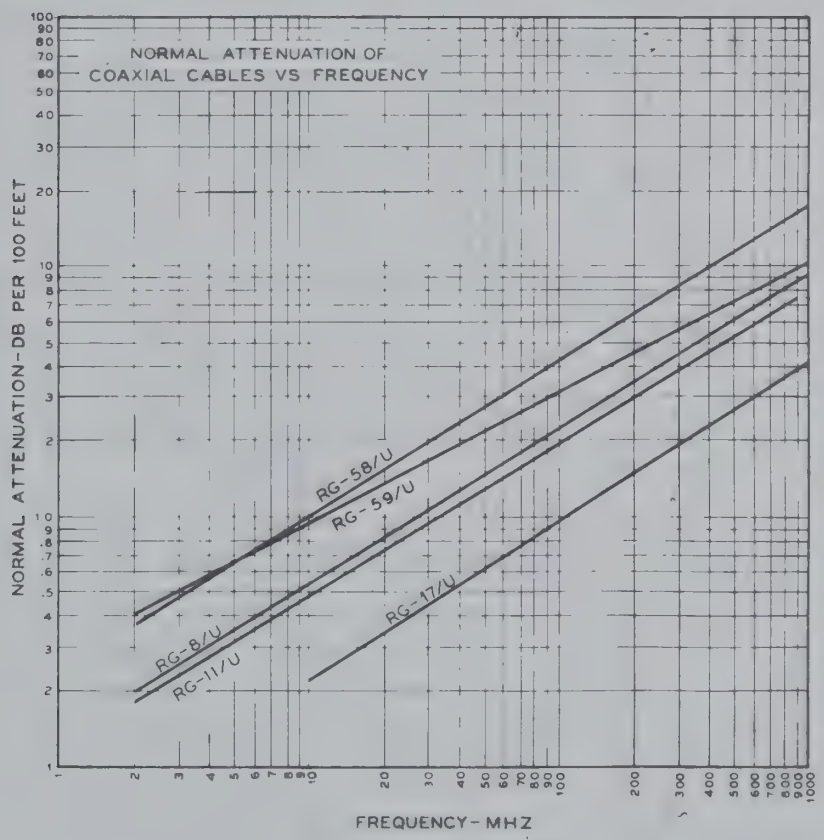


Figure 3

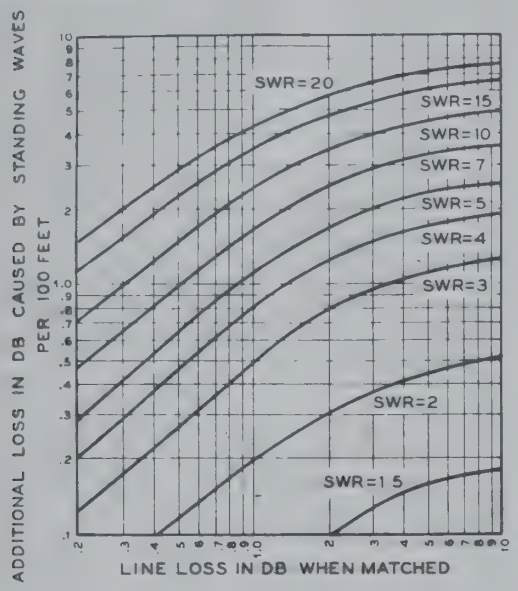


Figure 4

Now determine the additional loss caused by the SWR from Figure 4 as follows: Use the amount of loss determined from Figure 3 and find this value on the bottom line of Figure 4. Now move up the graph until you come to the SWR of your antenna system. Move over to the left-hand side of the graph and determine the amount of loss caused by the SWR. To obtain the total loss of your system, add the value from Figure 3 to the value from Figure 4.

Loading

The load presented to the transmitter output circuit may create conditions that make it touchy or impossible to load the transmitter. With a low SWR, the load that the transmitter "sees" is practically pure resistive. However, at a high SWR, the apparent load may change from a very low to a very high resistance, accompanied by either capacitive or inductive reactance. These resistance and reactance values change when the transmission line length or frequency is changed.

Remember when you are using 50-52 Ω or 70-75 Ω unbalanced feed lines, that the SWR cannot be changed by changing the transmission line length. However, the loading to the transmitter may be changed considerably, thus making it appear that "pruning" the cable length offers improvement, when it actually does not affect the SWR.

The SWR can only be changed by changing the load or termination at the end of the cable. If the transmission line length is changed, for example, with 50 Ω cable and a SWR of 3, the apparent load to the transmitter may vary from 16-2/3 Ω to 150 Ω resistive, with reactance varying from 66-2/3 Ω capacitive, to zero, to 66-2/3 Ω inductive. If the transmitter output tuning adjustments will not accomodate this impedance range, the transmitter will be difficult to load until the load is properly matched to the line. When the load is matched, the SWR will be lower.

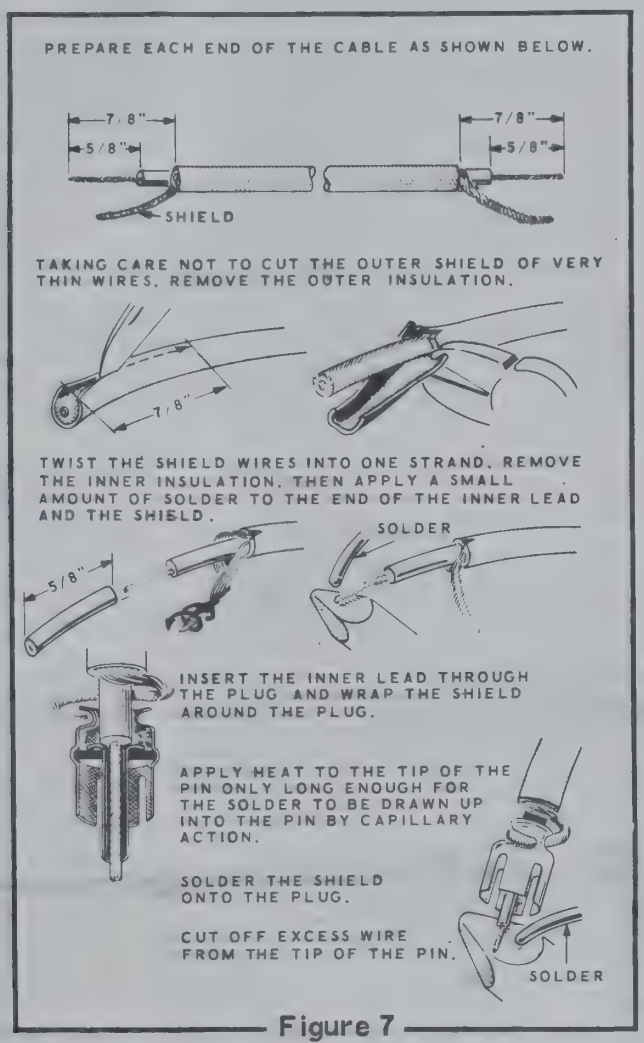

PREPARE EACH END OF THE CABLE AS SHOWN BELOW.
7/8"
5/8"
SHIELD
TAKING CARE NOT TO CUT THE OUTER SHIELD OF VERY THIN WIRES, REMOVE THE OUTER INSULATION.
TWIST THE SHIELD WIRES INTO ONE STRAND. REMOVE THE INNER INSULATION. THEN APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE INNER LEAD AND THE SHIELD.
SOLDER
INSERT THE INNER LEAD THROUGH THE PLUG AND WRAP THE SHIELD AROUND THE PLUG.
APPLY HEAT TO THE TIP OF THE PIN ONLY LONG ENOUGH FOR THE SOLDER TO BE DRAWN UP INTO THE PIN BY CAPILLARY ACTION.
SOLDER THE SHIELD ONTO THE PLUG.
CUT OFF EXCESS WIRE FROM THE TIP OF THE PIN.
SOLDER

Figure 7

PHONE PATCH

Installation

HEATH SB SERIES OF EQUIPMENT

To illustrate installation of the Phone Patch a transceiver, a receiver-transmitter combination, and a speaker have been selected from the Heath SB series of amateur equipment. Use the shielded audio cable and the phono plugs supplied to interconnect the equipment as shown in Figure 5 (fold-out from Page 26) and Figure 6 (fold-out from Page 35). Refer to Figure 7 for the installation of phono plugs.

( ) If not previously done, install a phono plug on the end of the lead from your station speaker. Connect this plug to the SPKR socket on the near of the Console.

( ) Connect the SPKR terminal of the transmitter (may be marked "8 Ω" on transceivers) to the RCVR terminal on the back of the Console. Use the shielded cable provided. The shield wires will make the essential ground connection between the pieces of equipment.

( ) Connect the HI-Z phone patch output to the PHONE PATCH input of your transmitting equipment. Use shielded cable.

CAUTION: To prevent the telephone ringing voltage from damaging the VU meter, be sure the ON-OFF switch is turned to OFF before you connect any leads to the telephone line.

( ) Connect one of the two LINE terminals on the back of the Console to the red wire on the telephone terminal block, and the other LINE terminal to the green wire on the terminal block. Polarity is not important. Disregard the yellow wire on the terminal block.

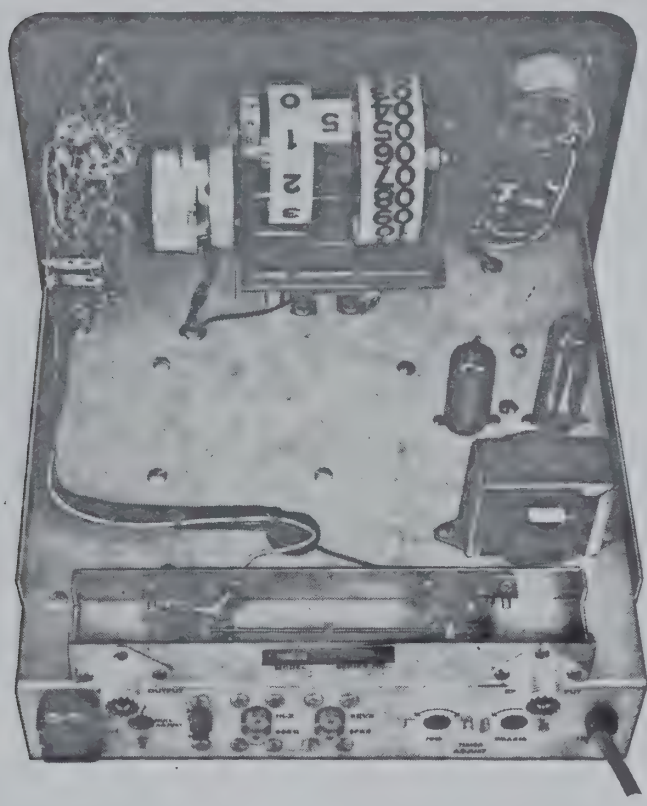
EQUIPMENT OTHER THAN HEATH

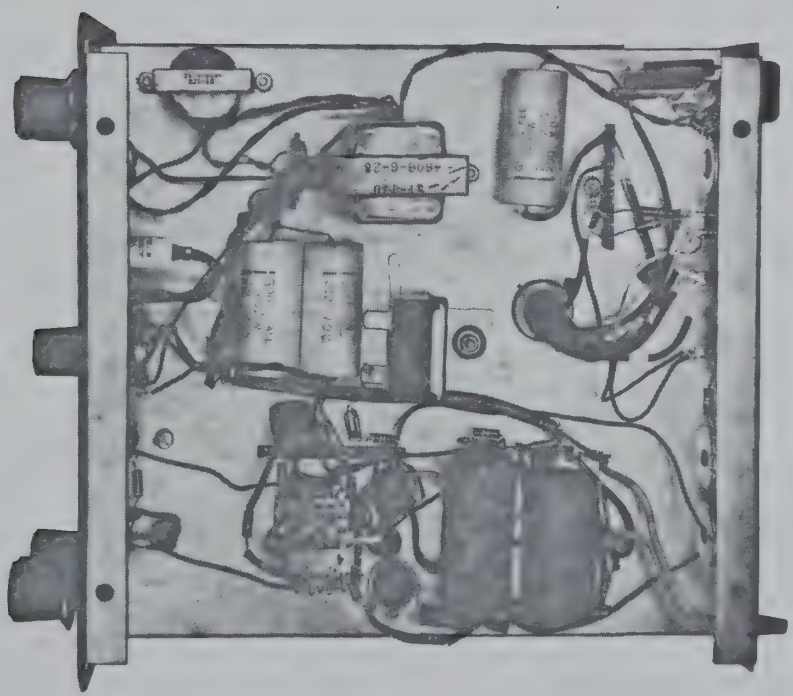
Connections to other makes of equipment will vary in details, but the same basic principles will apply. Some notes and suggestions follow:

1. Use shielded wire for all audio interconnecting lines as an aid in the suppression of RF feedback. It is usually unnecessary to use shielded wire between the telephone terminal block and the Phone Patch.

2. If not already provided, arrangements should be made to mute your receiver and to open the SPKR lead when transmitting.

CHASSIS PHOTOGRAPHS





3. If you want to use voice control but no anti-vox output is provided on your receiver, use shielded wire to connect the Anti-Vox transmitter input to the SPKR and GND terminals on the back of the Phone Patch.

4. Usually the HI-Z Phone Patch output will be associated with transmitter grid input circuits and the 600 Ω connection with cathode input circuits. Try both for suitability. Figure 8 shows some suggested microphone and Phone Patch output connections to the first audio stage of your transmitter.

5. If one of the terminals of your speaker is connected to the metal speaker frame, or is grounded in some other manner, connect this terminal to the GND connection on the Phone Patch, and the other speaker terminal to the SPKR connection. If neither speaker terminal is grounded, polarity is unimportant.

6. Make sure that shield wires are properly grounded at both ends to the equipment which they connect and that, if necessary, a separate ground wire interconnects all equipment.

( ) Readjust the Vox and Anti-Vox controls on your transmitting equipment after connecting the Phone Patch.

Null Adjustment

NOTE: Null adjustment is required only when the phone patch is to be used with voice-control operation. If only manual operation is to be used, omit the following steps and proceed to the Operation instructions.

CAUTION: Never try to make the null adjustment without actually placing a phone call. The impedance of a dead line, obtained when dialing only one digit, is different from the line impedance when a completed call is made.

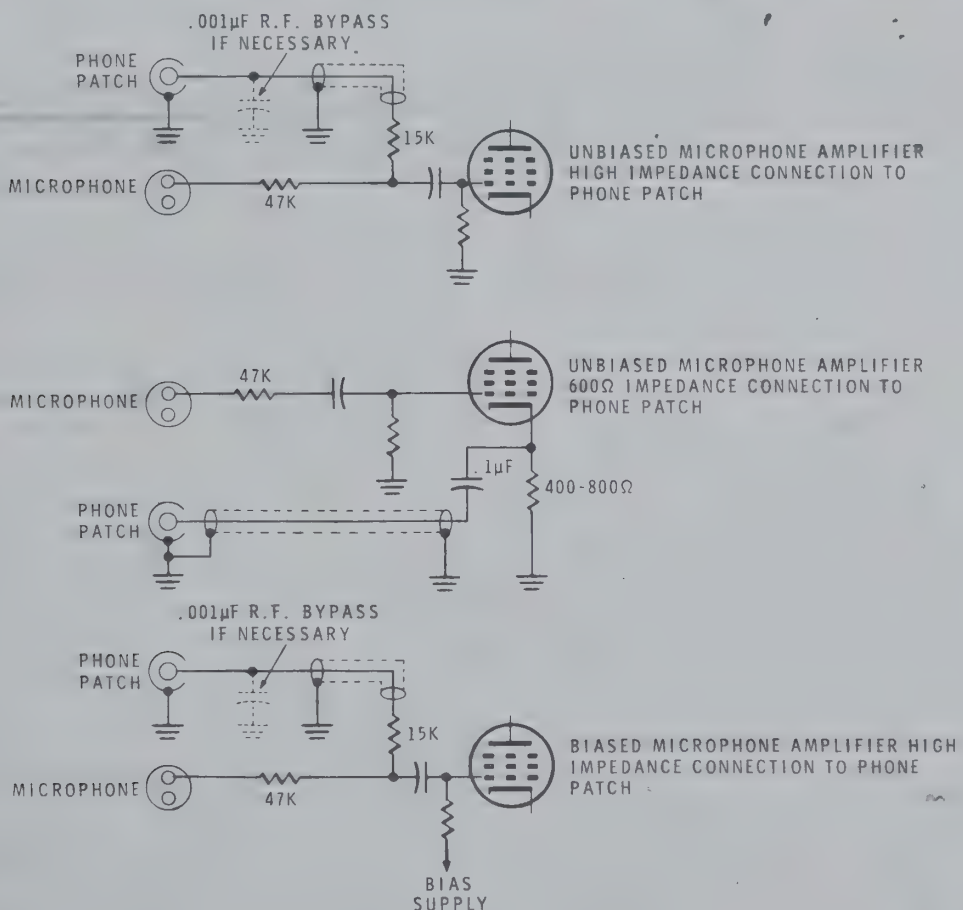
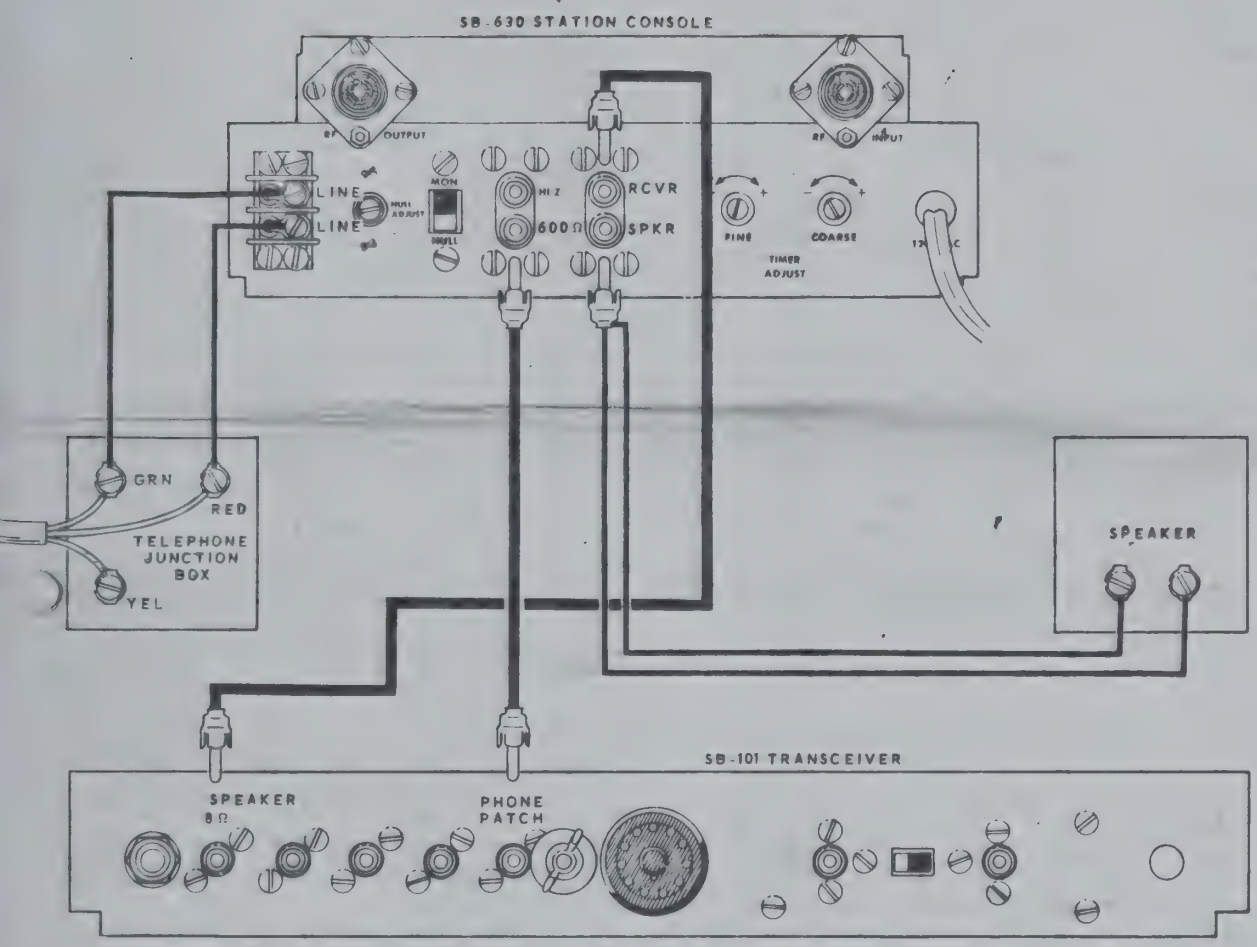


Figure 8



NOTE:
VOX AND ANTI-VOX ADJUSTMENTS ARE INTERIOR ON THE SB-100 AND SB-110 TRANSCEIVERS

FIGURE 6

( ) Set the Console controls and switches as follows:

NULL-MON switch - NULL.
NULL ADJUST control - Full counter-clockwise.
TRANS GAIN control - Full counterclock-wise.
RCVR GAIN control - 2/3 clockwise.
MODE switch - SWR METER.

( ) Tune in a strong heterodyne note of about 800 cps on the receiver. This can be done by beating a crystal calibrator against the receiver BFO.

( ) Call a friend on the phone. Someone on a different line is best. Explain that there will be a strong tone in the telephone receiver, that he should keep the phone away from his ear, and that he can hang up when the tone stops.

( ) Leave your telephone handset off the hook, and turn the MODE switch to PHONE PATCH.

( ) Advance the receiver AF gain control until the VU meter on the Console indicates zero VU.

( ) Adjust the NULL ADJUST control for a minimum VU meter indication, -20 or less. This dip should occur with about one-half rotation of the NULL ADJUST control.

( ) Turn the MODE switch to SWR METER and hang up the telephone handset.

( ) Place the NULL-MON switch in the MON position.

This completes the Null Adjustment of the phone patch.

Operation

The phone patch can be left connected at all times. When the MODE switch is in the SWR METER position, the phone patch is isolated from the telephone line. Use the phone patch in the following manner.

1. Be sure the MODE switch is turned to SWR METER; then dial the desired phone number.

2. When the called party answers, explain the procedure for speaking over a phone patch. Then turn the MODE switch to PHONE PATCH.

NOTE: When the NULL-MON switch is in the MON position, the VU meter indicates the listening level on the telephone lines. The telephone industry permits peaks up to zero VU. In testing the phone patch we have found that this level was much in excess of a comfortable listening level. The exact level will have to be determined by experimentation; however -10 VU seems to be satisfactory in most cases. NEVER PERMIT THE LEVEL TO EXCEED ZERO VU, AS IT MAY CAUSE CROSSTALK BETWEEN TELEPHONE CHANNELS.

3. Adjust the TRANS GAIN control to provide the desired modulation level, and adjust the RCVR GAIN to provide the desired listening level. It is not necessary to change the AF gain controls on the Receiver and Transmitter.

4. It is not necessary to switch the phone patch when changing from transmit to receive. The operator can use the telephone handset for a microphone and headset. When the phone patch call is completed, always turn the MODE switch to SWR METER.

IN CASE OF DIFFICULTY

Since the SB-630 Station Console consists of several independent circuits, a difficulty that might occur in one circuit would not necessarily affect other functions of the Console.

The following General information can be applied to the circuits, or sections, that do not function properly, without checking those circuits that appear to be normal.

1. Recheck the wiring in the faulty section. Have a friend check your work. Someone who is not familiar with the unit may notice something that is overlooked by the builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Soldering section of the Kit Builders Guide.

3. Check the values of the parts. Be sure that the proper parts have been wired into each circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.

4. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

If your difficulty is in the ten-minute timer circuit, make the following additional checks.

5. Check to be sure that the tubes are in their proper locations. Make sure that tube V1 (6EW6) lights up properly.

6. Check the tubes with a tube tester, or by substitution of tubes of the same types that are known to be good.

7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. Note: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10%.

Refer to the Kit Builders Guide for service and warranty information.

Troubleshooting Chart

This Chart is divided into the following four parts; Clock Circuit, Timer Circuit, SWR Meter Circuit, and phone patch circuit.

CLOCK CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
Clock does not run.	1. Line cord not connected. 2. Fuse blown. 3. Seconds dial drum rubbing against escutcheon window. 4. Faulty wiring of clock leads to AC power circuit.

TIMER CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
Tube V1 (6EW6) filament not lit.	1. Timer switch in OFF position. 2. Filament burned out. 3. Tubes V1 and V2 in wrong sockets. 4. Faulty wiring of filament circuit.
No Identify light when Reset button is pressed; buzzer sounds when Timer switch is in Aural position.	1. #47 pilot lamps burned out. 2. Faulty wiring of pilot lamps or Timer switch circuits. 3. Faulty Timer switch.
Buzzer does not sound when Reset button is pressed if Timer switch is in Aural position.	1. Faulty wiring of buzzer or Timer switch circuits. 2. Faulty Timer switch.
Neither buzzer nor Identify lights operate when Reset button is pressed.	1. Timer switch in Off position. 2. Dirty or faulty relay contacts 5 and 7. 3. Faulty Reset pushbutton switch. 4. Open 33 KΩ resistor R29. 5. Faulty Timer switch or its wiring.
Identify lights and/or buzzer comes on when TIMER switch turned from Off position.	1. Tube V1 (6EW6) shorted. 2. Neon lamp NE2 shorted. 3. Faulty circuit wiring.

DIFFICULTY	POSSIBLE CAUSE
Identify light or buzzer does not signal ten minute interval.	1. Tube V1 (6EW6) weak or dead. 2. Capacitors C21, C22, C23, or C24 faulty. 3. Resistors R22, R24, R25, R26, or R37 open. 4. Faulty diodes D5 or D6. 5. Dirty or faulty relay contacts.

NOTE: Voltage checks in the electronic circuits, when compared with the voltages shown on the Schematic, may help you locate difficulties in the ten-minute timer.

SWR METER CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
No meter reading when transmitting.	1. Mode switch in Phone Patch position. 2. Diode D1 or D2 open. 3. Jumper wire still connected across meter terminals.
Meter deflects backward when transmitting.	1. Diode D1 or D2 installed backward. 2. Meter wires reversed.
Low meter reading when transmitting.	1. SWR Meter switch in REV position. 2. Sensitivity control incorrectly set. 3. Insufficient transmitter power. 4. Resistor R1 or R2 open or wrong value. 5. Capacitor C1 or C2 faulty.

PHONE PATCH CIRCUIT

DIFFICULTY	POSSIBLE CAUSE
No meter reading when receiving.	1. RCVR gain control improperly adjusted. 2. Null-Mon switch in Null position. 3. Diode D3 faulty. 4. Resistor R4 open. 5. RCVR and SPKR plugs transposed.
Poor transmitter gain.	1. Null-Mon switch in Null position. 2. TRANS gain control improperly adjusted. 3. Wrong output impedance used.
Deep null not obtained.	1. Phone dialing not completed. 2. Null Adjust control improperly set.
No transfer of audio between telephone lines and station equipment.	1. Mode switch in SWR Meter position. 2. RCVR and TRANS gain controls improperly adjusted. 3. Resistor R6, R7, R9, or R11 open. 4. Transformers T1 and T2 incorrectly wired.

SPECIFICATIONS

CLOCK

Dial	4-drum, 24-hour, digital readout.
Motor	1 rpm at "seconds" drum; gear driven.
Power Requirements	120 VAC, 60 Hz, 3.7 watts. (Internally connected to Console AC line cord.)

TIMER

Time Interval	Adjustable to 10 minutes.
Time Stability	Less than .2 percent change per hour in normal ambient temperature.
Time Cycle	Instant reset with front panel pushbutton.
Signal	Visual or both visual and aural; switch selected from front panel, with Off position.
Circuit	Resistance-capacitance network. Neon-discharge, vacuum tube relay control.
Tube Complement	6EW6 Relay control. OA2 Voltage regulator.
Power Supply	Transformer operated, voltage regulated, fused.
Power Requirements	120 VAC 60 Hz, 15 watts.

SWR METER

Operation	Indicates percentage of forward and reflected power, and voltage standing wave ratio (SWR).
RF Power Handling Capability	2 kilowatts P.E.P.
Input And Output Impedance	50-52 Ω or 70-75 Ω.
Band Coverage	160 through 6 meters.

PHONE PATCH

Circuit	Telephone hybrid circuit. Allows voice control or manual operation. Single switch places unit in full operation.
Telephone Line Input Impedance	Approximately 600 Ω.
Null Depth	At least 30 db isolation between transmit and receive circuits.
Receiver Impedance	Effective match from 3 to 16 Ω.
Transmitter Impedance	600 Ω or high impedance output.

GENERAL CONSOLE SPECIFICATIONS

Meter	100 Microampere movement. VU readings for phone patch monitoring and null 'epth indication. Relative power and standing wave ratio readings for SWR meter.
Front Panel Controls	Mode: SWR Meter, Phone Patch. Timer: Off, Visual, Audio. Reset: Pushbutton. SWR Meter: Forward, Reverse. SWR Meter: Sensitivity. Phone Patch: Transmitter gain. Phone Patch: Receiver gain.
Rear Panel Controls	Timer Adjust. Null Adjust. Null - Monitor switch.
Dimensions	6-5/8" high x 10" wide x 11-1/8" deep (including knobs).
Net Weight	7-1/2 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 43) while you read this Circuit Description.

The Station Console contains the following independent circuits, which will be described separately: the Clock and Timer Circuit, the SWR Meter Circuit, and the Phone Patch Circuit. A review of the Installation And Operation section of this Manual will also help you understand the function of the circuits.

CLOCK AND TIMER CIRCUIT

The digital readout clock motor is connected to the AC power line through a 3/16 ampere slow-blow fuse. The clock runs continuously when the line cord is connected to a source of 120 V 60 Hz alternating current.

The timer circuit begins to operate when the Timer switch is turned from Off to either Visual or Aural. The neon pilot lamp indicates when the timer is on.

Power for the timer circuit is obtained from transformer T3, through the voltage doubling and filtering network of diodes D4 and D5 and capacitors C26 and C27. Transformer T3 also supplies 6.3 volts AC for the filament of tube V1, for signal buzzer L3, and for the #47 pilot lamps.

Tube V2 is a voltage regulator which keeps the DC supply voltage at a constant level, and resistor R38 is the limiting resistor for the regulator tube.

Resistors R24, R25, and R26 and capacitors C23 and C24 form an RC network with a very slow charging rate. The capacitors charge slowly through the resistors until the potential across the neon discharge lamp is sufficient to cause the lamp to conduct. When the lamp conducts, a positive pulse is sent through capacitor C22 to the grid of V1. The potential across the neon discharge lamp is governed by the setting of the Timer Adjust controls, which are in the voltage divider circuit of R34, R35, R36, and R37, and series resistor R33.

The positive pulse that is applied to the grid of V1 causes the tube to conduct and pass current through resistor R31 and the coil of the relay. With the relay coil energized, contacts 5 and 7 close to apply 6.3 VAC to the #47 pilot lamps (and to buzzer L3).

When relay contacts 1 and 9 close, capacitor C25 discharges through resistors R32 and R27 to hold the grid positive (and hold the relay closed) for approximately one second. The values of resistors R27 and R32, in series with capacitor C25, determine the length of time required for C25 to discharge. Thus, a higher resistance for R27 would increase the time that the relay would remain closed and the identify window lit. Contacts 2 and 9 of the relay had caused capacitor C25 to charge from the power supply before the relay closed.

While the relay coil is energized, contacts 3 and 8 close to discharge capacitors C23 and C24 through resistor R28; then the timing cycle begins again.

When the Reset button is pressed, current flows from the power supply, through the relay coil, the Reset button contacts, and resistor R29 to ground. This energizes the relay coil to close the relay contacts and restarts the timing cycle.

SWR METER CIRCUIT

The SWR Meter circuit is based upon the circuit of a device developed at the U.S. Naval Research Laboratory, Washington, D.C., and described in N.R.L. report No. 3538, titled "A Reflectometer for H-F Band." Simplified versions have also been described in various amateur radio publications.

The SWR meter consists of a short section of transmission line to which two small linear inductors are coupled, both inductively and capacitively. The radio frequency current flowing in each inductor and its load resistor is rectified by a germanium diode and filtered by a ceramic capacitor. Because L1 is terminated at the output and L2 is terminated at the input, the rectified current in L1 indicates forward relative power, while the rectified current in L2 indicates reverse relative power. The SWR Meter switch selects the direct current output of either diode and applies it to a variable-sensitivity metering circuit, consisting of a linear potentiometer and a microammeter.

The Mode switch connects the meter to the output of the sensitivity control in the SWR Meter position, and the meter indicates reflected power, or SWR. In the other position, the Mode switch is connected to the Phone Patch circuit which will be described next.

PHONE PATCH CIRCUIT

The phone patch circuit is based on the use of special hybrid transformer T1. The hybrid transformer with proper adjustment of the Null-Adjust control, will provide a high degree of isolation between the receiving and transmitting circuits. This feature is required for stable voice-control operation.

The operation of a hybrid transformer is shown in Figures 9 and 10. Refer to the Schematic Diagram (fold-out from Page 43) while reading this Description.

Figure 9 shows the phone patch in the Transmit cycle; that is, energy from the telephone line is being routed to the transmitter. The turns ratio of the hybrid transformer is such that the impedance of windings C, D, and Z_T are equal. If voltage E (representing an incoming voltage of the telephone line) is impressed on the transformer, it will at a given instant, cause current to flow as shown by the arrows. The opposing voltage drop across winding C will equal that across winding Z_T. Identical winding D is linked by the same flux as winding C; therefore it will have an induced (opposing) voltage of equal magnitude and in the same direction as winding C. The induced voltage in winding D is equal to the voltage across winding Z_T, and since their like polarities are connected together, no current flow will occur through Z_B. The result is that one-half of the incoming energy is available at the transmitter input and the other half is dissipated across Z_R.

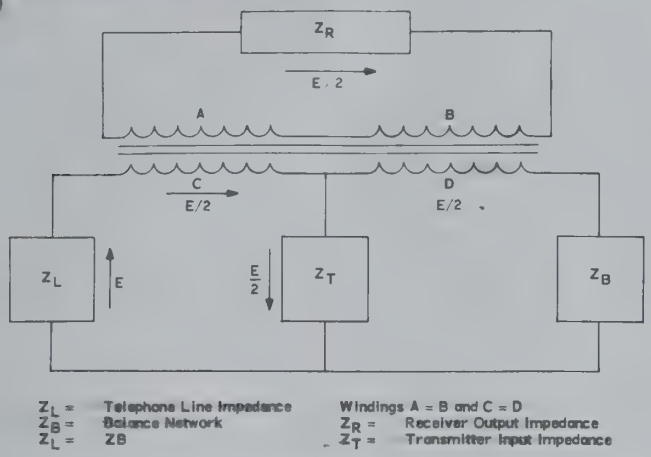


Figure 9

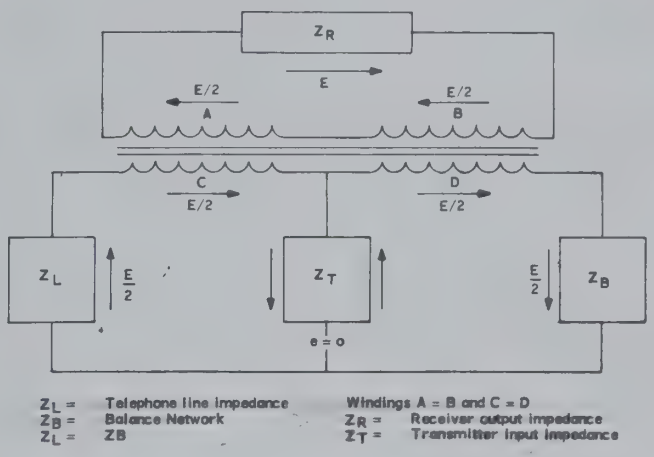


Figure 10

In Figure 10, the phone patch is shown in the receive cycle, with the signal from the receiver routed to the telephone line. If voltage E (representing a voltage from the receiver) is impressed on the transformer, it will, at a given instant, cause current to flow as shown by the arrows. Windings A and B are connected in series aiding.

Equal voltages are induced in each winding, since winding C equals winding D. The balance network is adjusted so that Z_B equals Z_L, therefore the voltage drops across Z_B and Z_L are equal. This will cause equal and opposite currents through Z_T, so there is no voltage across Z_T and no energy is fed to the transmitter input.

The turns ratio of the transformer windings (T1 and T2) match the speaker and transmitter input impedances to the hybrid windings of transformer T1.

The phone patch circuit, and the meter, are coupled to the telephone line when the Mode switch (S3) is turned to the PHONE Patch position. The meter, coupled through resistors R4 and R5 and diode D3, closely approximates standard VU readings. A zero VU reading represents 4 db above 1 milliwatt in 600 Ω, and is the maximum voltage allowed on the telephone lines to avoid crosstalk between channels.

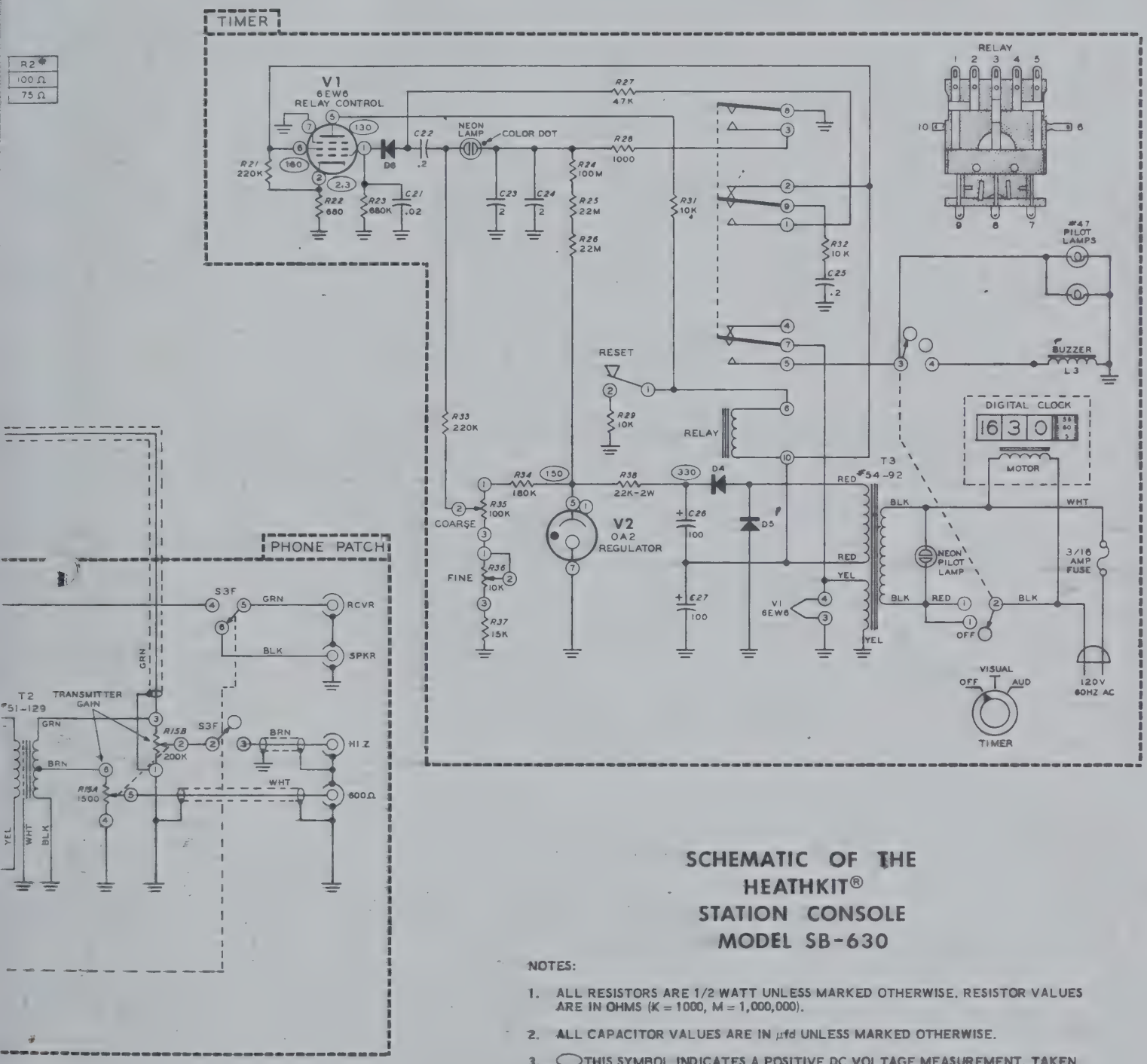
A Null-Monitor switch, S2, is provided on the rear apron so the VU meter can be used as a null indicator when the balance network is adjusted. In the Null position of S2, resistor R5 is switched out of the circuit to increase the sensitivity of the meter.

The telephone line connections to the phone patch are filtered by a balanced pi network to prevent RF from entering the phone lines and/or the transmitter audio circuits.

Since the impedance of telephone lines vary greatly from installation to installation, it is necessary to isolate the line impedance so a simple balance network will provide a sufficient null at every installation. This is accomplished by connecting the telephone line to the phone patch through an H pad. This H pad, which is formed by resistors R6, R7, R8, R9, and R11, has an impedance of 600 Ω. The pad forces the line impedance to appear as approximately a 600 Ω resistance. This allows the impedance of Null Adjust control R14 with resistor R13 to equal the line impedance and provide a deep null.

In order to provide a balanced load to the telephone line, an important feature in minimizing hum, the hybrid transformer incorporates additional windings, and the resistive pad is made in the "H" form.

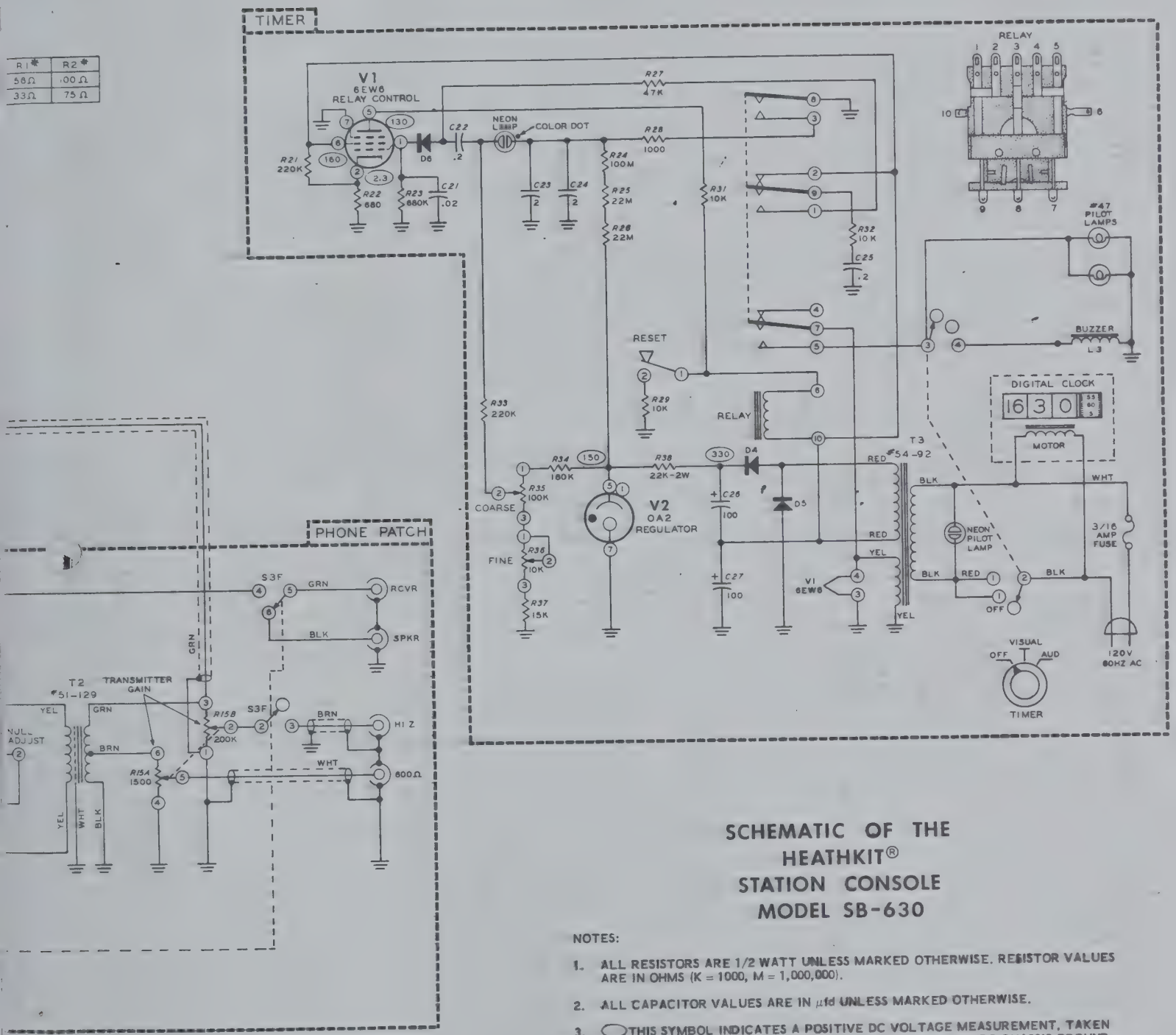
The telephone line is also connected to the phone patch through capacitor C7. This capacitor blocks the DC voltage of the telephone line but allows the audio frequencies to pass. The large value of capacitance has very little reactance at audio frequencies, thus allowing the phone patch to maintain good audio quality.



SCHEMATIC OF THE HEATHKIT® STATION CONSOLE MODEL SB-630

NOTES:

1. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K = 1000, M = 1,000,000).
2. ALL CAPACITOR VALUES ARE IN μfd UNLESS MARKED OTHERWISE.
3. (150) THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT, TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±10%.
4. ALL SWITCH WAFERS SHOWN IN FULL COUNTERCLOCKWISE POSITION, AS VIEWED FROM THE KNOB END OF THE SHAFT.



R1*	R2*
56Ω	100Ω
33Ω	75Ω

SCHEMATIC OF THE HEATHKIT® STATION CONSOLE MODEL SB-630

NOTES:

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2. ALL CAPACITOR VALUES ARE IN μfd UNLESS MARKED OTHERWISE.
3. (130) THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT, TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±10%.
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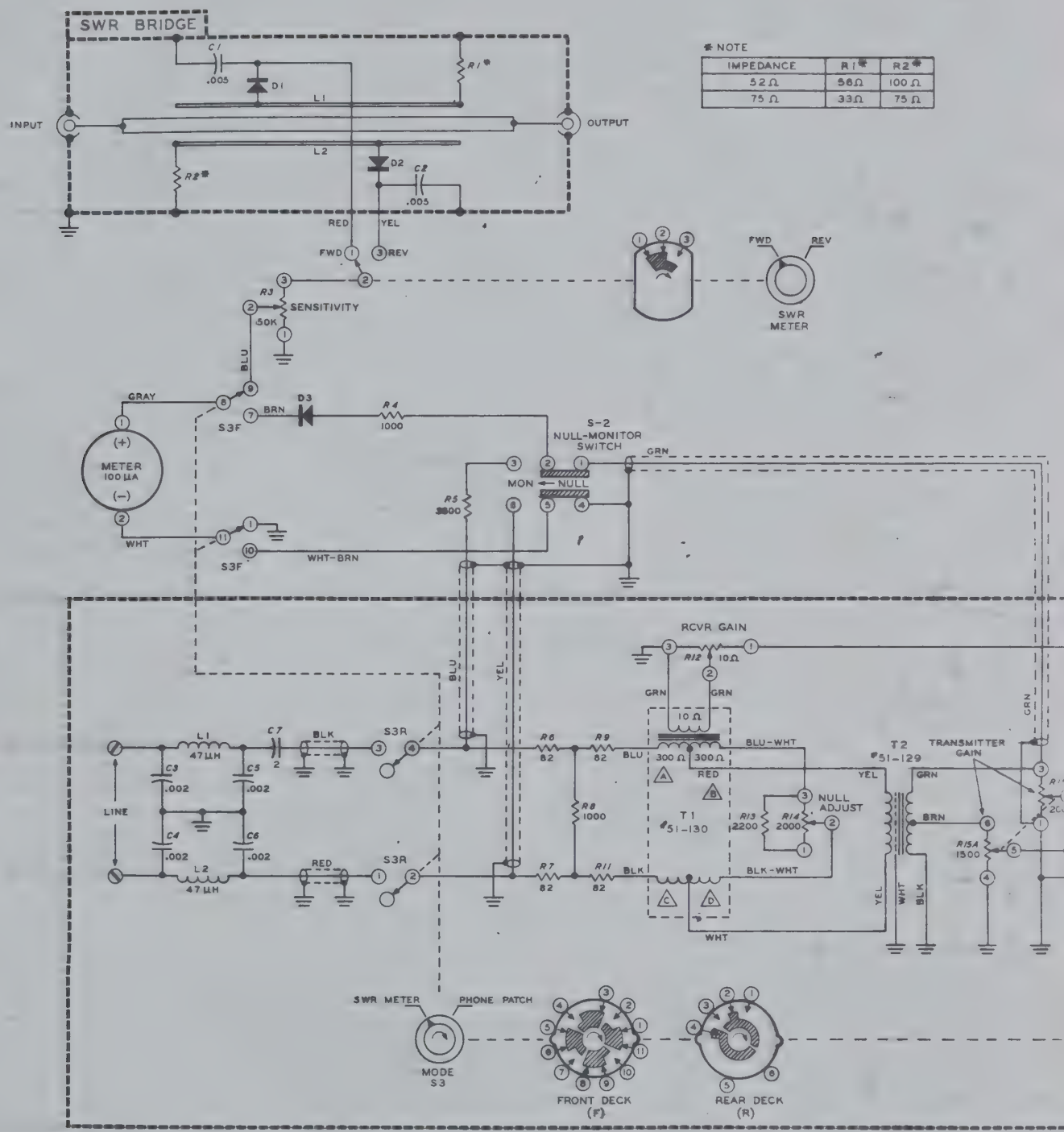
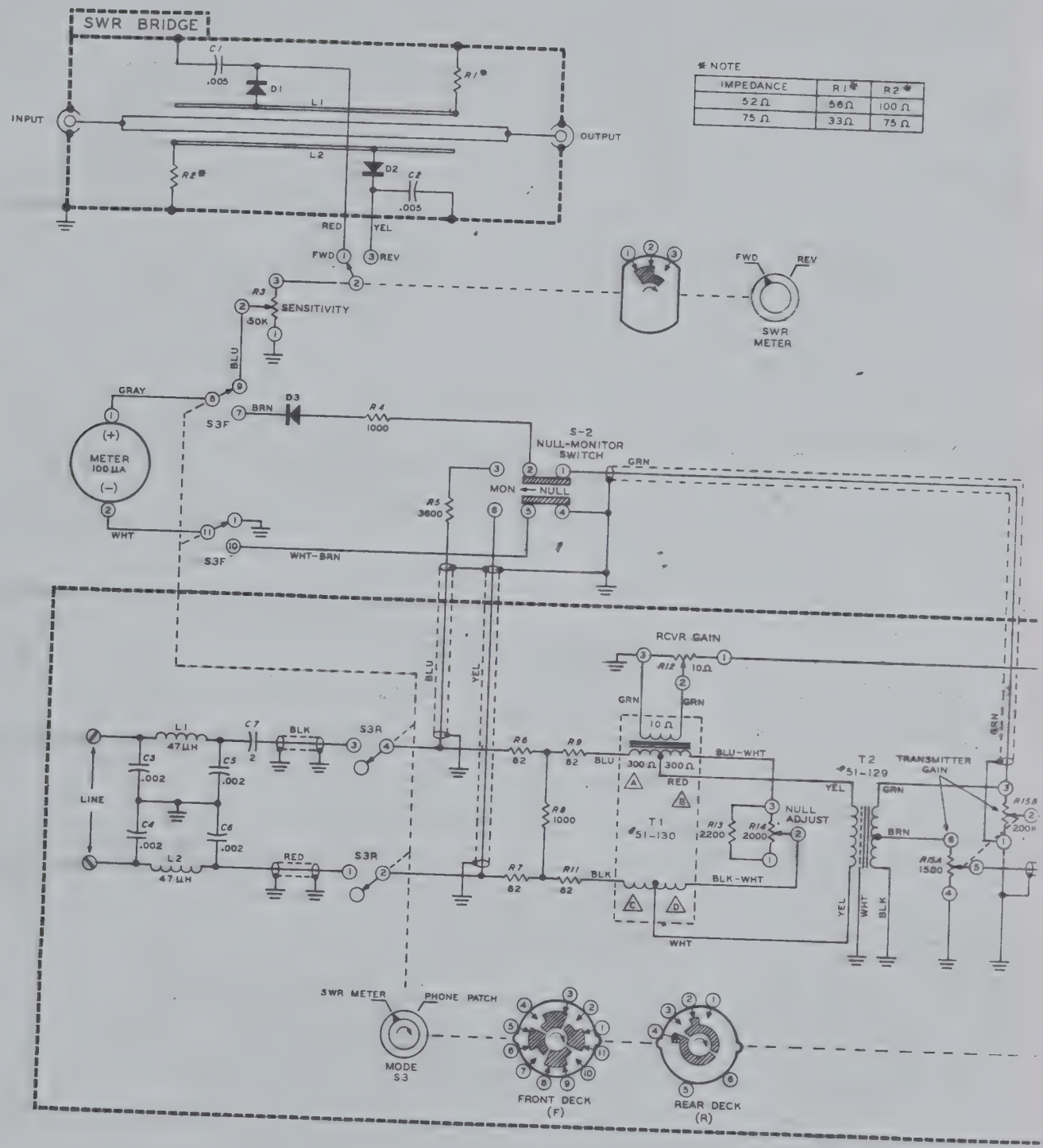


* NOTE

IMPEDANCE	R1*	R2*
52Ω	56Ω	100Ω
75Ω	33Ω	75Ω



* NOTE

IMPEDANCE	R1 *	R2 *
52Ω	56Ω	100Ω
75Ω	33Ω	75Ω

REPLACEMENT PARTS PRICE LIST

RT No.	PRICE Each	DESCRIPTION
ISISTORS		
2 Watt		
103	.10	33 Ω
33	.15	56 Ω
146	.10	75 Ω
118	.10	82 Ω
123	.10	100 Ω
7	.10	680 Ω
9	.10	1000 Ω
14	.10	2200 Ω
32	.10	3600 Ω
20	.10	10 KΩ
21	.10	15 KΩ
25	.10	47 KΩ
26	.10	180 KΩ
29	.10	220 KΩ
34	.10	680 KΩ
70	.10	22 megohm
39	.10	100 megohm
Watt		
[illegible]	.20	22 KΩ
PACITORS		
36	.10	.002 μfd disc
27	.10	.005 μfd disc
31	.10	.02 μfd disc
34	.25	.2 μfd resin
21	1.15	2 μfd tubular
57	.95	100 μfd electrolytic
NTROLS		
64	1.35	10 Ω wire-wound
11	.50	50 KΩ
52	.40	2000 Ω tab-mount
57	.35	10 KΩ tab-mount
58	.35	100 KΩ tab-mount
68	1.45	1500 Ω and 200 KΩ dual
ITCHES		
2	.25	DPDT slide
7	.90	SPST pushbutton
[illegible]	.85	2-position rotary
[illegible]	1.85	3-position rotary
428	2.95	2-section rotary

PART No.	PRICE Each	DESCRIPTION
COILS-CHOKE-TRANSFORMERS		
40-98	.55	RF driver element
40-99	.10	RF pickup element
45-2	.25	47 μH RF choke
51-129	3.05	Input transformer
51-130	4.95	Hybrid line transformer
54-92	2.80	Power transformer
DIODES-TUBES-LAMPS-FUSE		
56-26	.30	1N191 germanium diode
57-27	.60	Silicon diode
411-59	1.35	OA 2 tube
411-170	1.20	6EW6 tube
412-10	.85	Snap-in neon lamp
412-34	.55	Neon lamp
412-20	.20	#47 pilot lamp
421-40	.40	3/16 ampere slow-blow fuse
TERMINAL STRIPS		
431-16	.10	2-lug
431-28	.10	2-lug vertical
431-70	.30	2-lug screw-type
431-62	.10	3-lug miniature
431-10	.10	3-lug
431-11	.10	5-lug
431-45	.10	6-lug
SOCKETS-CONNECTORS-PLUGS		
434-34	.15	Tube socket
434-82	.10	Double phono socket
434-88	.15	Pilot lamp socket
436-5	.85	Coaxial connector
438-4	.10	Phono plug
HARDWARE		
Screws		
250-49	.05	3-48 x 1/4"
250-2	.05	4-40 x 3/16"
250-56	.05	6-32 x 1/4"
250-162	.05	6-32 x 1/2"
250-143	.05	6-32 x 1/2" stud
250-29	.05	6-32 x 3/4"
250-40	.05	6-32 x 1-1/2"
250-8	.05	#6 x 3/8" sheet metal
250-93	.05	8-32 x 1/4" setscrew

PART No.	PRICE Each	DESCRIPTION
Nuts		
252-1	.05	3-48
252-3	.05	6-32
252-7	.05	Control nut
252-10	.05	Speednut
Washers		
254-7	.05	#3 lockwasher
254-9	.05	#4 lockwasher
254-1	.05	#6 lockwasher
253-60	.05	Thin #6 flat washer
253-27	.05	Thick #6 flat washer
253-1	.05	#6 fiber washer
254-5	.05	Control lockwasher
253-10	.05	Control flat washer
Other Hardware		
259-1	.05	#6 solder lug
259-10	.05	Control solder lug
255-21	.20	7/8" tapped spacer

WIRE-CABLE-HARNESS-SLEEVING

89-1	.35	Line cord
344-50	.05/ft	Hookup wire
347-9	.10/ft	3-wire shielded cable
134-141	4.65	Harness
346-1	.05/ft	Sleeving

SHEET METAL PARTS

90-337	8.70	Cabinet shell
200-477-1	2.75	Chassis
203-458-1	.85	Front panel
206-325	.35	SWR bridge base
206-326	.25	SWR bridge cover

PART No.	PRICE Each	DESCRIPTION

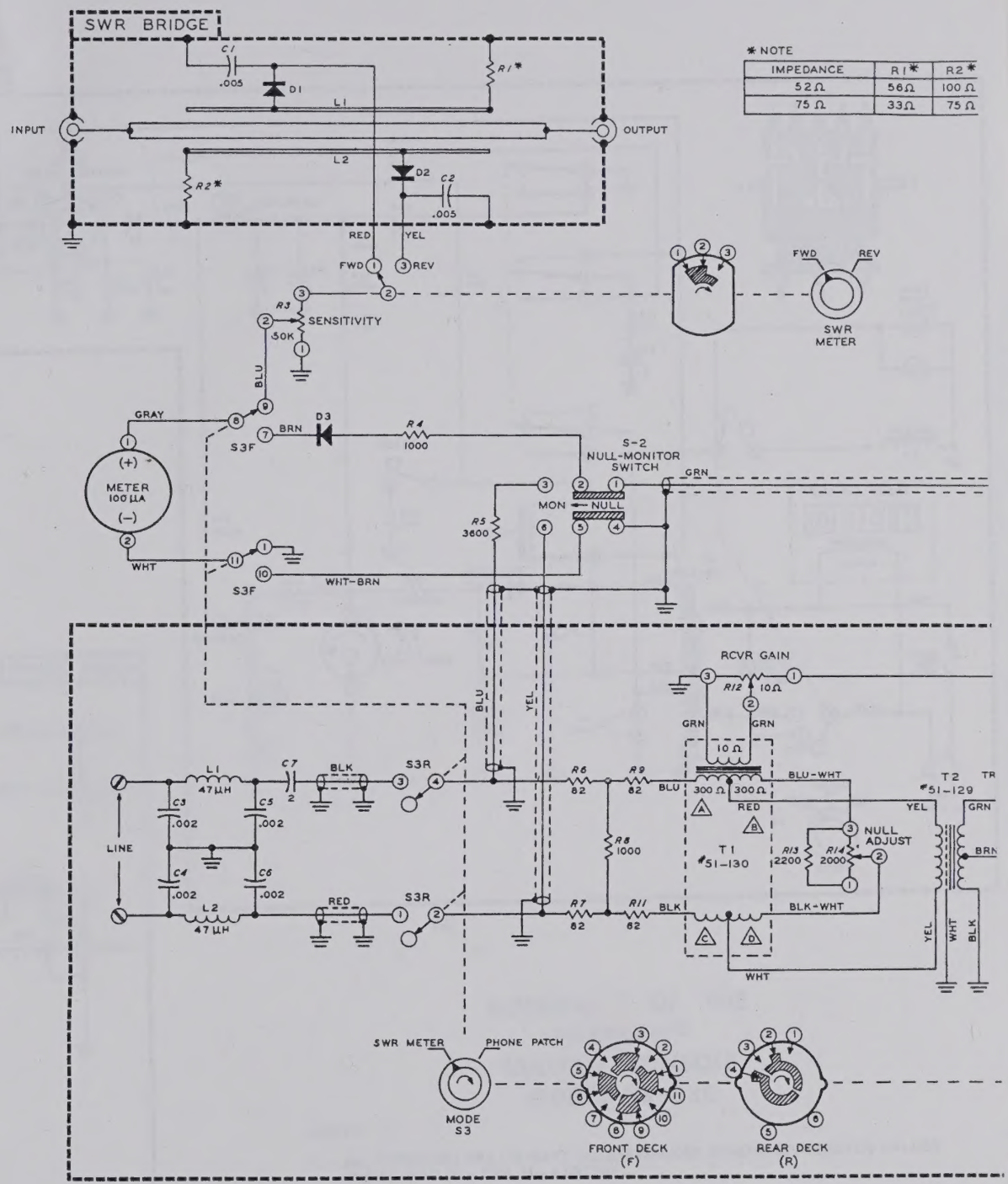
PLASTIC AND RUBBER PARTS

100-603	1.80	Escutcheon
73-4	.10	5/16" rubber grommet
73-46	.10	5/16" plastic grommet
73-43	.10	3/8" plastic grommet
73-44	.10	3/4" plastic grommet
75-24	.10	Line cord strain relief
255-12	.10	Plastic spacer
261-9	.05	Rubber foot
261-25	.05	Plastic foot
255-59	.15	Foot spacer

MISCELLANEOUS

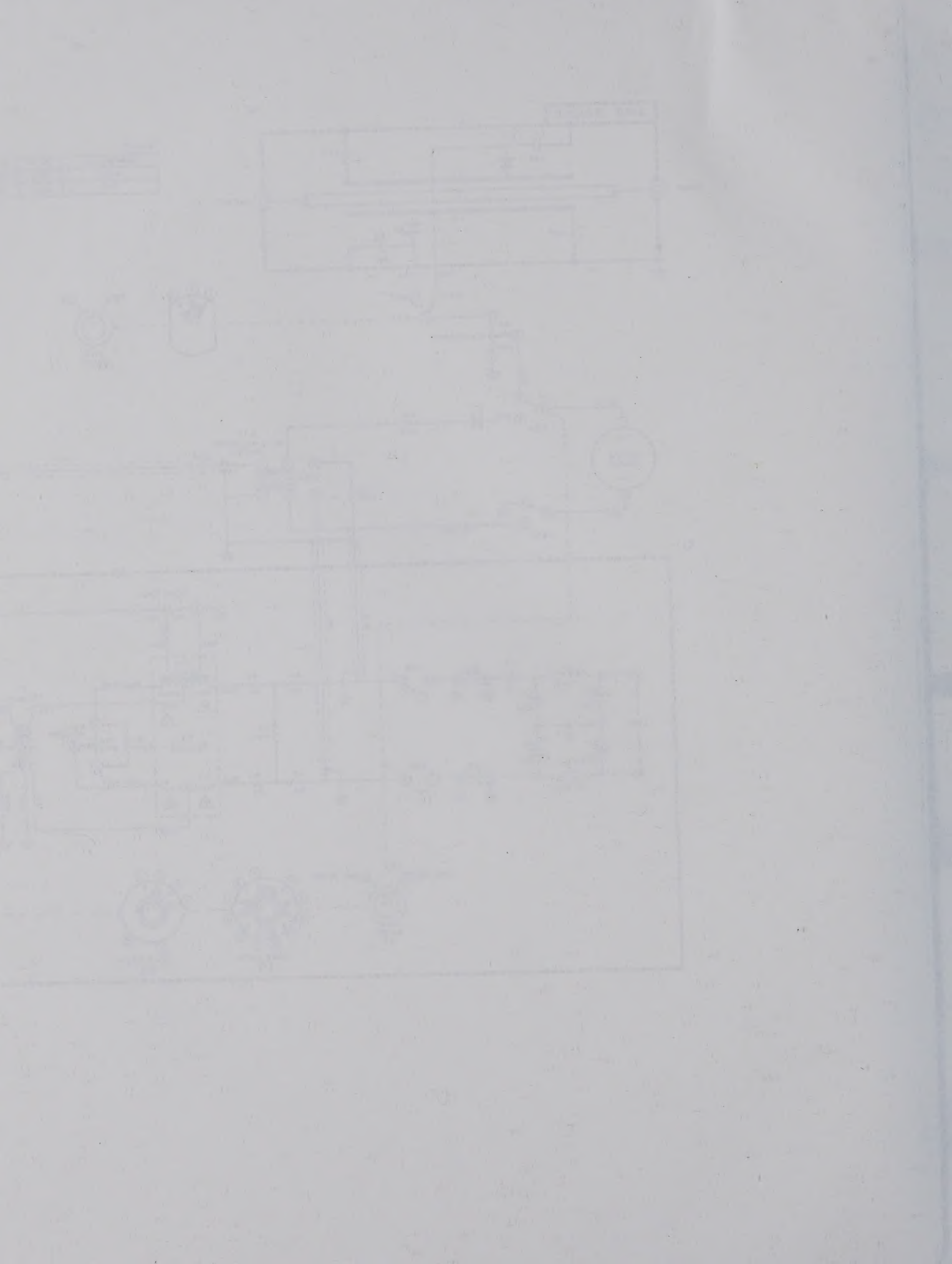
69-34	5.00	DPDT relay
69-42	1.50	Buzzer
406-49	20.00	Clock movement
407-114	9.50	Meter
462-159	.30	Small knob
462-191	.70	Skirted knob
391-48	1.20	Heathkit nameplate
490-5	.10	Nut starter
490-6	.10	#8 allen wrench
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)

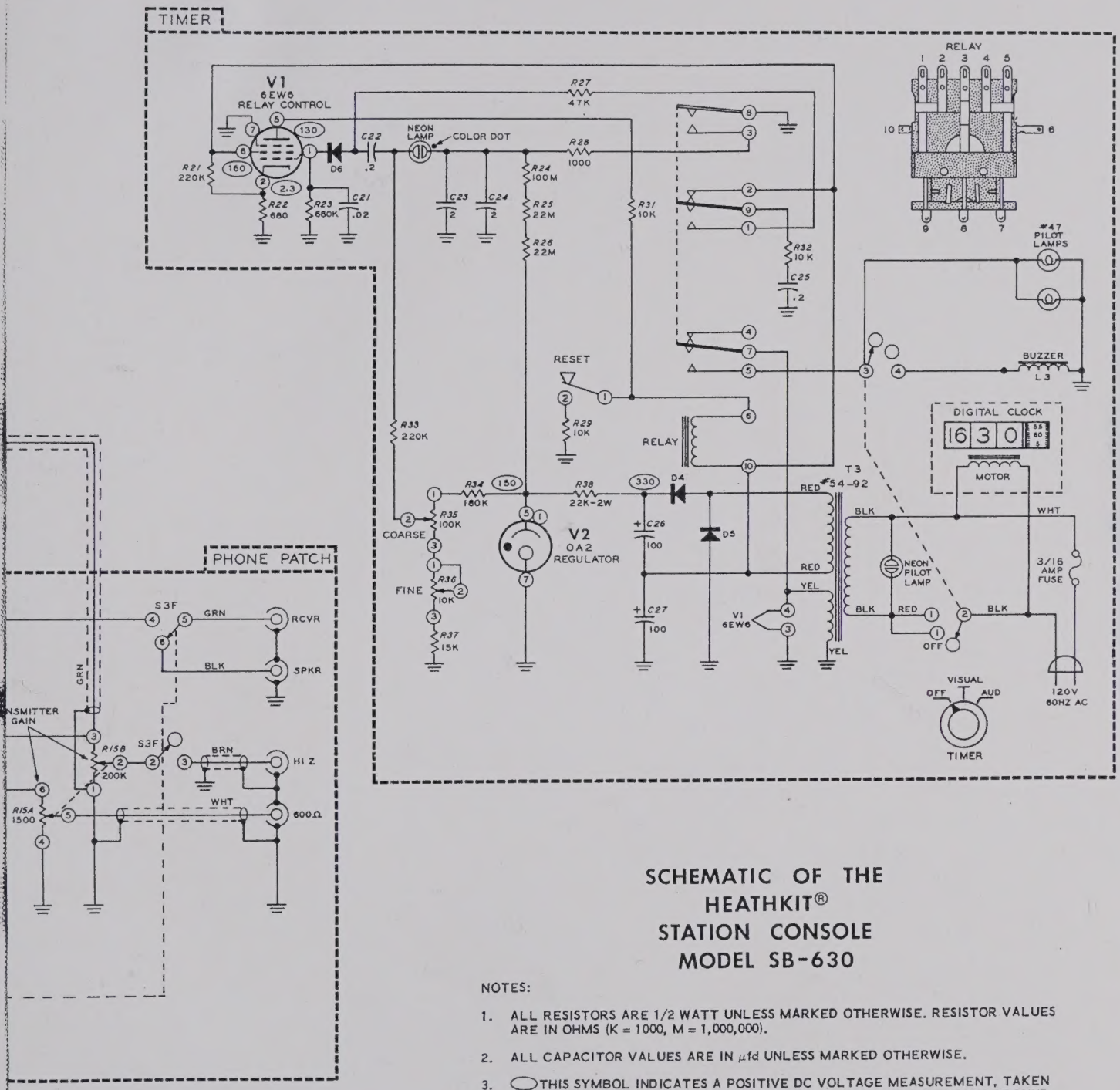
The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from an authorized Service Center or Heathkit Electronic Center to cover local sales tax, postage and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.



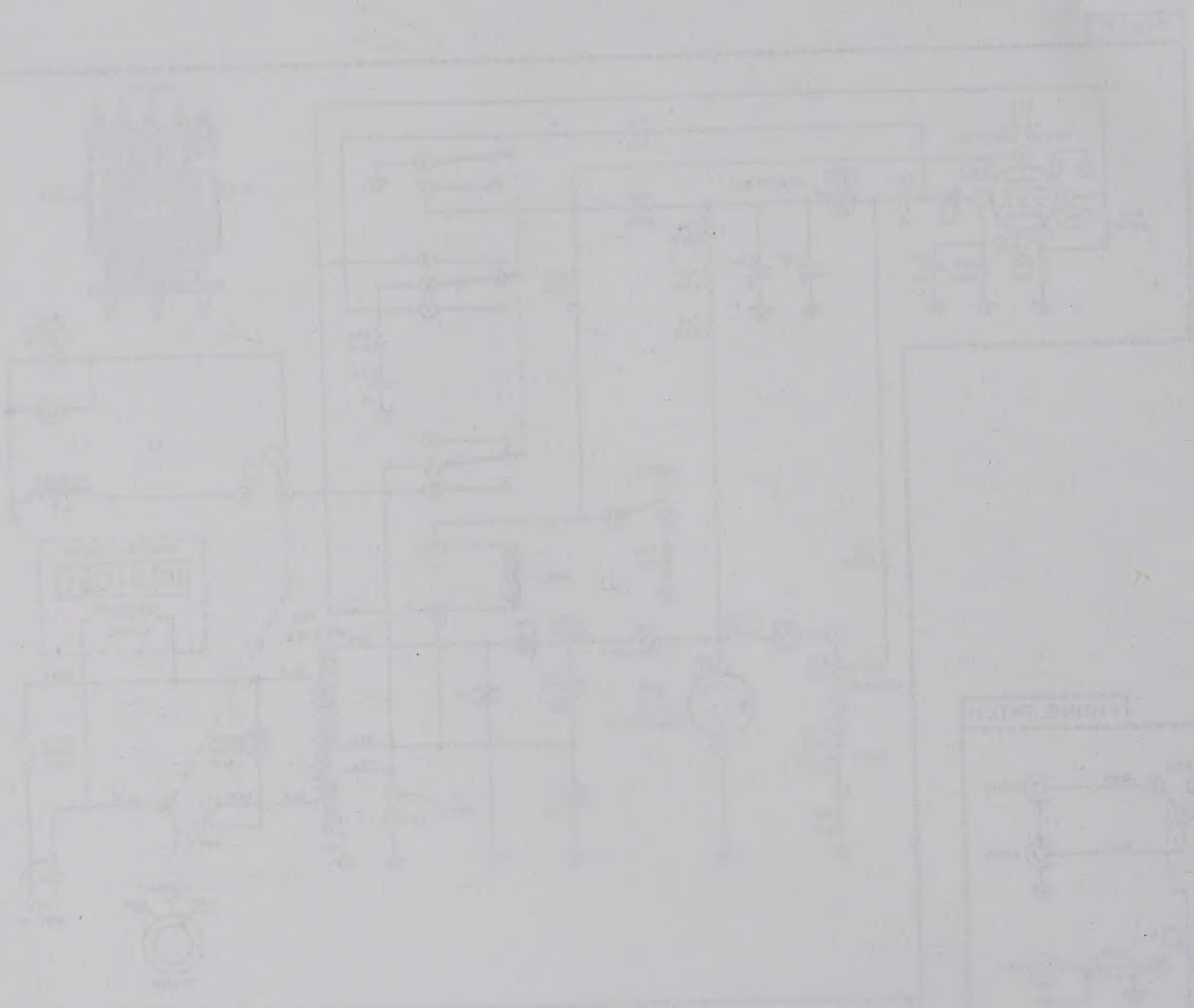
* NOTE

IMPEDANCE	R1*	R2*
52Ω	56Ω	100Ω
75Ω	33Ω	75Ω





SCHEMATIC OF THE HEATHKIT® STATION CONSOLE MODEL SB-630

NOTES:

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